PROPOSED PLAN

Proposed Final Cleanup for the Upper Blackfoot Mining Complex State Superfund Facility

Lewis and Clark County, Montana

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ACRONYM LIST

ABA	Acid-Based Accounting
AOC	Administrative Order on Consent
ARCO	Atlantic Richfield Company
ASARCO	American Smelting and Refining Company
ATSDR	Agency for Toxic Substances and Disease Registry
BER	Board of Environmental Review
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BMP	best management practice
BTEX	Benzene, Ethylbenzene, Toluene, Xylenes
CDC	U.S. Centers for Disease Control and Prevention
CECRA	Comprehensive Environmental Cleanup and Responsibility Act
cfs	cubic feet per second
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DAF	Dilution Attenuation Factor
DEQ	Department of Environmental Quality
DHHS	Department of Health and Human Services
DOJ	Department of Justice
DSR	Data Summary Report
EA	Evaluation Area
EE/CA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency
EU	Exposure Unit
FCM	Food Chain Model
FS	Feasibility Study
gpm	Gallons per minute
HHRA	Human Health Risk Assessment
IARC	International Agency for Research on Cancer
IASD	Initial Alternatives Screening Document
IC	Institutional Control
MCA	Montana Code Annotated

MDHES	Montana Department of Health and Environmental Sciences
MDSL	Montana Department of State Lands
mg/kg	Milligrams per kilogram
MGWPCS	Montana Groundwater Pollution Control System
MNA	Monitored Natural Attenuation
MNR	Monitored Natural Recovery
MPDES	Montana Pollutant Discharge Elimination System
NRDP	Montana Department of Justice Natural Resource Damage Program
NRIS	Natural Resource Inventory System
O&M	Operation & Maintenance
PLP	Potentially Liable Person
PRAO	Preliminary Remedial Action Objective
PRB	Permeable Reactive Barrier
QSC	Qualifying Soil Concentration
RBCA	Risk-based Corrective Action
RI	Remedial Investigation
ROD	Record of Decision
SPLP	Synthetic Precipitation Leaching Procedure
SSCL	Site Specific Cleanup Level
TMDL	Total Maximum Daily Load
TRUST	Montana Environmental Trust Group
UBMC	Upper Blackfoot Mining Complex
USFS	United States Forest Service
VCRA	Voluntary Cleanup and Redevelopment Act
WBZ	Water-bearing Zone
WRA	Watershed Restoration Agreement
WTP	Water Treatment Plant
WWTS	Wetlands-based Water Treatment System
yd^3	Cubic Yard

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) has prepared this Proposed Plan to identify its preferred final remedy for completing cleanup activities on non-federal lands at the Upper Blackfoot Mining Complex (UBMC) Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Facility (Figure 1) in Lewis and Clark County, Montana. DEQ has determined there has been a release or substantial threat of a release into the environment that may present an imminent and substantial endangerment to the public health, safety or welfare or the environment. The Proposed Plan identifies and explains DEQ's preferred alternative for addressing this imminent and substantial endangerment. The document also summarizes the cleanup alternatives evaluated for the non-federal land at the UBMC. DEQ will select the final remedy for the non-federal lands at the UBMC and present it in a Record of Decision (ROD) after reviewing and considering relevant information, including but not limited to comments submitted during the public comment period on the Proposed Plan. DEQ may modify the preferred remedy or select another remedy if DEQ determines a different remedy is more appropriate. The public is encouraged to comment and to offer suggestions for improving the remedy or reasons to implement other cleanup alternatives.

The U.S. Forest Service (USFS) is responsible for selecting the remediation on the National Forest System (federal) lands within the UBMC. In July 2007, the USFS released its Action Memorandum identifying the required cleanup at a portion of its property within the UBMC. The USFS amended that Action Memorandum in July 2012. This Proposed Plan does not address any of the federal lands within the UBMC for which the USFS already selected a cleanup. For those federal lands within the UBMC that were not included in the Action Memorandum, as amended, the USFS will issue a separate decision. This Proposed Plan identifies DEQ's preferred remedy for the non-federal land within the UBMC.

DEQ's issuance of this Proposed Plan is part of its public participation responsibilities under Section 75-10-713, Montana Code Annotated (MCA). This Proposed Plan summarizes information found in greater detail in the Data Summary Report (DSR), Remedial Investigation (RI), Feasibility Study (FS), and some of the other documents contained in DEQ's files for the UBMC. The Proposed Plan is based on the information found in these documents and is summarized in the following sections. The complete file is available at DEQ's office in Helena. There is also a partial compilation of these resources at the Lewis and Clark County Library, the Lincoln Ranger Station, the Lincoln Library, and on DEQ's website at http://deq.mt.gov/StateSuperfund/UBMC/default.mcpx

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Lincoln Ranger District

1569 Highway 200

Lincoln, MT 59639 Business Hours: Monday – Friday: 8 am – 5 pm

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Lincoln Library (Lewis and Clark Library Branch)

102 9th Street

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406-362-4300 Closed Saturday

Lewis and Clark County Library

120 S. Last Chance Gulch

Helena, MT 59601 Business Hours: Sunday – Saturday (hours vary)

406-447-1690

2.0 PUBLIC INVOLVEMENT

Public involvement is an important part of CECRA and DEQ encourages public comment on this Proposed Plan. The public comment period for the Proposed Plan will extend from October 10, 2015, to November 9, 2015. Comments received through the postal service must be postmarked no later than November 9, 2015, and comments submitted electronically must be received no later than 11:59 pm MST on November 9, 2015. During this time, the public can comment in writing to:

David Bowers

DEQ-Remediation Division

P.O. Box 200901

Helena, MT 59620-0901

or

dbowers@mt.gov

DEQ will hold the combined public meeting and hearing on October 28, 2015, at 7 pm at the Lincoln Community Hall located at 404 Main Street in Lincoln, Montana. DEQ will summarize the preferred remedy during the first segment of the public meeting and will answer questions concerning the preferred remedy. During the second portion of the meeting, questions will not be answered, but DEQ will accept and record verbal comments on the Proposed Plan. A responsiveness summary, which is a written response to public comments (including both written comments and verbal comments from the public hearing), will be included in the ROD.

Verbal comments will not be accepted over the phone; however, you may call David Bowers for additional information at 406-444-6335 or 1-800-246-8198.

3.0 BACKGROUND

The UBMC Facility includes a mixture of federal and private lands (Figure 2) that lie within a portion of the historic Heddleston Metal Mining District (Heddleston District) in the Rocky Mountains of Lewis and Clark County, Montana. The UBMC is located approximately 15 miles east of Lincoln, Montana, in the headwaters area of the upper Blackfoot River and covers an area of approximately six square miles including several sections within Township 15 North, Range 6 West. The UBMC includes a number of individual historical underground mines that developed deposits occurring principally as narrow, fault-controlled, base-metal (silver-lead-copper-zinc) veins. The Mike Horse Mine, the largest producing mine within the UBMC, occurs at latitude 47º01'31.87" North, and longitude 112º21'41.48" West (Tetra Tech 2013a).

Historical mining activity at the UBMC has resulted in hard-rock mining wastes and acidic discharges. Human health and environmental issues are caused by elevated levels of metals present in mine waste piles, tailings, surface water, groundwater, sediments, water discharging from mine adits, and contaminated waste redeposited as stream sediments. The Mike Horse Tailings Impoundment was a significant source of contaminated waste redeposited as stream sediments. The impoundment was constructed on the Beartrap Creek drainage in 1941 for disposal of tailings from the Mike Horse Mine mill. In June 1975, heavy precipitation, along with blockage of a surface water diversion ditch by mudslide debris, caused the Mike Horse Tailings Impoundment to be breached. As a result, approximately 200,000 cubic yards (yd^3) of tailings were washed downstream and deposited on the Beartrap Creek and Upper Blackfoot River floodplain (USFS 2007). Numerous investigations have been conducted to characterize contamination in mine wastes. Contaminants at the UBMC include, but are not limited to, aluminum, arsenic, cadmium, copper, lead, iron, manganese, and zinc (Tetra Tech 2013a).

4.0 REGULATORY HISTORY

In 1987, the Montana Legislature allocated funds to the Montana Department of State Lands (MDSL; now part of DEQ) for reclamation of the Mike Horse Mine (part of the UBMC) under the State's abandoned mine reclamation program, with additional funding allocated in 1989. MDSL performed site characterization activities and reclamation planning from 1987 through 1990, including plans for mine waste removal and water treatment designs (MDSL 1990). In 1990, however, the Montana Department of Health and Environmental Sciences (MDHES, now DEQ – both agencies will be collectively referred to as DEQ within this document), determined that potentially liable persons (PLPs) may exist for the Mike Horse Mine, and the state's reclamation plans were put on hold (MDHES 1990-91).

In June 1991, American Smelting and Refining Company (ASARCO) and the Atlantic Richfield Company (ARCO) were identified by DEQ as PLPs under CECRA for hazardous or deleterious substance contamination at the UBMC. DEQ identified the need for the PLPs to complete an RI and FS and to implement a remedy to be determined by DEQ (MDHES 1991).

Between February 1992 and May 1993, ASARCO and ARCO proposed implementation of a voluntary reclamation program at the UBMC in lieu of completing the RI and FS. Terms and conditions of ASARCO's and ARCO's proposal are outlined in a May 1993 letter, including preparation and submittal of annual work plans and other documents. DEQ reviewed plans and work, but did not approve any of the work (MDHES 1993a). Interim actions proceeded under this agreement until 1998, when interim actions of the Paymaster Mine and No. 3 Tunnel area proceeded under the newly established Montana Voluntary Cleanup and Redevelopment Act (VCRA) (MFG 1996). (The No. 3 Tunnel Area is on USFS property but was included in the VCRA plan.) ASARCO chose to forego submitting a construction completion report, required under the VCRA closure process, and that action resulted in DEQ voiding its approval of the voluntary cleanup plan (DEQ 2003).

In 1995, ASARCO received a Montana Pollutant Discharge Elimination System (MPDES) permit for discharge of treated water from the Mike Horse and Anaconda mine adit discharges (MDHES 1995). The MPDES permit (MTR-0030031) regulated the discharge of treated water to the Blackfoot River from a passive wetlands-based water treatment system (WWTS) that was constructed in 1995-96.

In 1996, ASARCO received a Montana Groundwater Pollution Control System (MGWPCS) permit (permit MGWPCS-001001) for treatment and subsurface discharge of a small (two gallons per minute (gpm) or less) seasonal flow from the Paymaster adit (DEQ 1997). The Paymaster MGWPCS permit expired in September 2003 and was not renewed, since no discharge was ever recorded from the Paymaster Mine water treatment wetlands cell (DEQ 2006). ASARCO also held an authorization to discharge storm water from the UBMC under Montana's general permit for storm water discharges (Authorization MTR300157). The storm water permit remained in effect until May 2011, when DEQ's Site Response Section assumed administrative duties to monitor water quality compliance under its CECRA authority (MDHES 1993b; DEQ 2011a).

In June 2000, upon petition by ASARCO, the Montana Board of Environmental Review (BER) approved temporary water quality standards in portions of Mike Horse Creek, Beartrap Creek,

and the upper Blackfoot River (Hydrometrics 1999); the temporary standards were established in the Montana Surface Water Quality regulations (ARM 17.30.630). The temporary standards modified the water quality standards for a number of metals, including cadmium, copper, iron, lead, manganese, and zinc, as well as pH, until 2008. As part of the temporary standards petition process, ASARCO developed a conceptual plan for mitigation of all mining contamination causing water quality exceedances that was identified in the Temporary Standards Implementation Plan (Hydrometrics 2000).

In November 2002, ASARCO entered into an Administrative Order on Consent (AOC) with the USFS for performance of an Engineering Evaluation/Cost Analysis (EE/CA) to develop removal action alternatives for contamination on certain federal lands within the UBMC. The AOC covered federal lands along portions of Mike Horse Creek, Beartrap Creek (including the Mike Horse tailings impoundment), and the Blackfoot River upstream of the confluence with Pass Creek (Figure 2). These areas were affected by historical mining operations, including those related to the Mike Horse Mine and tailings impoundment (Hydrometrics 2007).

In 2003, DEQ brought legal action in state district court against ASARCO, ARCO, and ARCO Environmental Remediation, LLC, for recovery of DEQ's past and future remedial action costs associated with the UBMC, to require the companies to implement required remedial actions, and for a declaratory judgment to establish liability for all future remedial action costs, including cleanup costs, which DEQ would incur in connection with the UBMC (First Judicial District Court 2003). In 2007, DEQ amended its legal action to include a claim for natural resource damages.

In 2005, ASARCO prepared a draft data summary report as part of an interim settlement of the pending litigation (Hydrometrics 2005a). DEQ reviewed the draft report and provided comments to ASARCO and ARCO. DEQ's review of the revised document (Hydrometrics 2005b) indicated that the companies had not incorporated DEQ's comments adequately. Therefore, DEQ revoked the interim settlement agreement and completed the report itself (Tetra Tech 2007).

In August 2005, ASARCO filed for Chapter 11 bankruptcy. DEQ, the Montana Department of Justice (DOJ) through its Natural Resource Damage Program (NRDP), and the USFS filed claims in the bankruptcy. The parties settled these claims as part of two separate settlement agreements. The first settlement involved both ASARCO and ARCO and provided the State of Montana and United States with approximately $40 million. ASARCO remained responsible for the water treatment plant and maintenance of the Mike Horse, Paymaster, and Carbonate repositories (U.S. Bankruptcy Court 2008). As part of these settlements, DEQ dismissed the state court action. DEQ and NRDP entered into a Watershed Restoration Agreement (WRA) with the USFS, whereby DEQ would implement the cleanup selected by the USFS for federal lands addressed in the Action Memorandum (WRA 2008). DEQ and NRDP also entered into a Memorandum of Agreement which addressed DEQ and NRDP coordination regarding UBMC remedial and restoration actions related to the 2008 settlement agreement. In 2009, the State of Montana, United States, and ASARCO entered into a second settlement agreement whereby ASARCO's UBMC real property holdings and water treatment plant and repository maintenance obligations were transferred to the Montana Environmental Trust Group (Trust), along with approximately $10 million in funding (US Bankruptcy Court 2009). The Trust is the current owner of most of the UBMC being addressed in this Proposed Plan (Figure 2).

In December 2006, the BER revoked the temporary water quality standards due to the failure of ASARCO to implement the Temporary Standards Implementation Plan (Implementation Plan) (BER 2006). One of the Implementation Plan requirements was that the WWTS must be modified to meet water quality standards. However, the WWTS continued to represent a source of metals loading to the Blackfoot River as reported in the Water Quality Restoration Plan for Metals in the Blackfoot Headwaters TMDL Planning Area (TMDL-total maximum daily load; DEQ 2003). In 2007 and 2008, ASARCO continued to treat water from the Mike Horse and Anaconda mine adit discharges using the WWTS. In 2008, ASARCO constructed a ceramic microfiltration water treatment plant (WTP) (CDM 2008) at the same location, replacing the WWTS in January 2009. These discharges were regulated under MPDES permit MTR-0030031 until May 2011 when DEQ's Site Response Section assumed administrative duties to monitor water quality compliance under its CECRA authority (DEQ 2011).

In July 2007, the USFS released the EE/CA prepared by ASARCO as well as an Action Memorandum that selected the cleanup on certain federal lands within the UBMC (Hydrometrics 2007). The Action Memorandum included: (1) total removal of the Mike Horse Dam and tailings impoundment with placement of the waste into a within-drainage repository; (2) complete removal of mine waste from Lower Mike Horse Creek and placement of the waste into a within-drainage repository; (3) removal of all concentrated and intermixed tailings from the active floodplain of Beartrap Creek and placement of the waste into a within-drainage repository; and (4) complete mine waste removal (estimated at 45,000 yd^3) from the Upper Blackfoot River and placement of the waste into a within-drainage repository. The Paymaster Repository, previously constructed by ASARCO as part of its VCRA plan, was identified as the preferred within-drainage repository, subject to further verification that it was a suitable location (USFS 2007).

Subsequently, several design level investigations of the Paymaster Repository area for placement of additional mine waste were conducted and the USFS determined that the Paymaster Repository was not suitable due to concerns regarding constructability, space, volume, cost, and protectiveness. Based upon those investigations, in July 2012, the USFS issued an amendment to the 2007 Action Memorandum and selected a new repository location, often referred to as the Section 35 Repository; the USFS determined it was the most protective location for a new repository and the most appropriate based upon constructability, space, volume, cost, and protectiveness (USFS 2012).

In 2007, DEQ initiated an RI of the UBMC in order to identify the nature and extent of contamination which had not been adequately characterized. The RI field work was performed in the fall 2007 and summer 2008. DEQ conducted a supplemental investigation in November 2011 to address specific data gaps (Pioneer 2012). The RI Report (Tetra Tech 2013a) discusses the results of the 2007, 2008, and 2011 work.

In 2009, DEQ initiated a Baseline Risk Assessment that included a Baseline Ecological Risk Assessment (BERA) and a Baseline Human Health Risk Assessment (HHRA). The primary objective of the BERA was to evaluate site-specific risk to plants, invertebrates, fish, birds, and mammals to support risk management decisions and future remedial actions at the UBMC (Tetra Tech 2013b). The primary objective of the HHRA was to evaluate site-specific risk to human health from exposure to soil, sediment, groundwater, and surface water (Tetra Tech 2014). Because metals are natural occurring in the environment, DEQ collected facility-specific background samples from unimpacted areas at the UBMC that are representative of natural conditions (Tetra Tech 2013a). The site-specific risks in both risk assessments were quantified

and site-specific cleanup levels (SSCLs) were developed. The BERA and HHRA are discussed in Section 8.0.

In 2011, NRDP issued its Conceptual Restoration Plan for the UBMC (RDG 2011). NRDP began implementation of its restoration plan in 2015, in conjunction with DEQ's interim actions and implementation of the Action Memorandum, as amended. Consistent with the DEQ and NRDP Memorandum of Agreement, DEQ and NRDP will be coordinating the UBMC remedial and restoration actions.

In 2013, DEQ began to develop, screen, and evaluate remedial action alternatives in an FS. Using the RI characterization, DEQ developed and screened a list of remedial action technologies in the Initial Alternatives Screening Document (IASD) (Pioneer 2013). Remedial technologies most applicable to the UBMC were retained for further screening and evaluation in the FS and used to develop the remedial alternatives for the UBMC (Pioneer 2015).

5.0 PREVIOUS INVESTIGATIONS AND INTERIM ACTIONS

The earliest monitoring activities at the UBMC date back to the 1960s with the majority of sampling performed by ASARCO or ARCO beginning in 1991 and continuing through 2005 (Tetra Tech 2007). DEQ evaluated the previous data prior to the RI to determine if there was already sufficient data to determine the nature and extent of contamination. While the data, collected from 1994-2005, was collected using generally consistent sampling and analytical techniques, it was limited in scope and additional data was needed. Tables 3 and 4 summarize past monitoring activities. Because of the limited scope of historic data collection, DEQ completed a comprehensive RI (Tetra Tech 2013a).

ASARCO and ARCO conducted numerous interim actions to address environmental impacts from historical mining activities at the UBMC and to meet various permit requirements. Accumulations of mine waste, including mine waste rock and tailings, were identified in portions of the UBMC. Several mine waste piles were located in drainage bottoms resulting in metals leaching to surface water. From 1993 through 1997, ASARCO and ARCO removed mine waste piles associated with various UBMC mines and placed the waste in engineered repositories. Other interim actions performed by ASARCO and ARCO at various UBMC mines included filling two mine shafts, plugging several mine adits, and treating mine waste in place. In 1996, ASARCO and ARCO constructed two wetland systems, the WWTS to treat drainage from the Mike Horse and Anaconda mine adits, and the Paymaster passive wetland treatment system (WTS) to treat drainage from the Paymaster Adit. In 2006 ASARCO also completed additional mine waste removal at the Mike Horse Mine. Figure 3 provides a site map showing the location of each exposure unit (EU; mine and other waste areas investigated in the RI) that underwent interim actions in the 1990s, other interim actions that followed such as the construction of the WTP, plus other non-interim action areas investigated during the RI. The following is a site-by-site chronology of interim actions completed at the UBMC and includes the EU number (if applicable) associated with that particular mine area and the timeframe for the actions performed at that particular mine area. If surface water and/or groundwater are impacted at an EU, it will also be discussed since the interim actions objectives included improving the contaminated waters in those areas. The non-interim action areas include:

- certain EUs (EU 2, EU 7, EU 11, EU 12, and EU 13)
- discrete areas of groundwater contamination in the vicinity of the Anaconda, Carbonate, Mike Horse, and Paymaster mine areas
- 24 mining-related features (exploratory adits, prospect pits and trenches, drill pads, etc.) found throughout the mountainous terrain at the UBMC.

Detailed descriptions of the 24 mining-related features are found in Appendix B. All of these non-interim action areas are addressed, including the proposed action for each area, later in the Preferred Remedy section (Section 11). The extent of contamination in all EUs is discussed by media in the Facility Contamination section (Section 7), while the Preferred Remedy section (Section 11) includes discussion about the specific contamination found at each EU as well as the proposed action to address the contamination.

5.1 Anaconda Mine – EU 1 (1994-96)

The Anaconda Mine is located at the headwaters of the Blackfoot River adjacent to the confluence of Anaconda Creek and Beartrap Creek (Figure 3). The area is divided into a lower waste pile area located next to the Blackfoot River at the site of the WTP and an upper waste pile area (EU1A and EU1B) on the hillside beginning approximately 200 feet in elevation above the WTP and the Blackfoot River (Figure 4).

5.1.1 Lower Waste Pile Area

Approximately 33,500 $yd^3$of mine waste was removed from the lower and upper Anaconda Mine areas in 1994 and 1995 and placed in the Mike Horse Repository (Figure 1; Hydrometrics 1995 and 1996; Pioneer 2015). Most of the removed mine waste came from two waste piles originally located on the floodplain of the Blackfoot River (Figure 4). The piles' proximity to the floodplain resulted in leaching of metals and erosion and subsequent transport of mine waste to the river (Hydrometrics 1995). The lower Anaconda Mine area confirmation sampling was performed in 1995 in the larger eastern pile removal area, which is mostly within the area of Cell 4 and Cell A at the WTP. The confirmation sampling for the western pile removal area was performed in 2008 during the construction of the WTP. Additional confirmation sampling was performed between the eastern and western piles when Cell 5 was rebuilt in 2011. Two to six feet of clean fill was used over this area to construct the WWTS. Therefore, the confirmation sampling results are considered representative of subsurface soil (greater than two feet below ground surface (bgs)) and were compared to the construction worker and soil leaching to groundwater location-specific screening level based upon the soil synthetic precipitation leaching procedure (SPLP) result of 340 mg/kg. The confirmation sampling results for all three of these subsurface areas are protective for construction workers. All of the confirmation sampling results for the lower waste pile areas are also protective of groundwater (see Table 5). The nearest monitoring wells are in the lower Anaconda Mine area. All the groundwater monitoring results (ANMW-3, ANMW-7, ANWS-1; Figure 4) for the lower Anaconda Mine area meets SSCLs (Table 2; Tetra Tech 2007, Tetra Tech 2013a).

5.1.2 Upper Anaconda Mine Waste Removal Areas – EU 1A

Two additional mine waste dumps located on the hillside adjacent to the Anaconda Mine were also reclaimed in 1995. The largest of the dumps was removed and placed in the Mike Horse Repository. Because of its distance from any surface water drainage, the other dump was reclaimed in-place by amending with cement kiln dust, re-grading, covering with growth medium, and applying a seed/mulch mixture (Hydrometrics 1996). ASARCO and ARCO did not conduct any confirmation sampling at the upper waste removal area, so it was sampled during the RI in 2007 and 2008 to assess the effectiveness of the previous interim actions in that area. Arsenic, cadmium, copper, lead, and zinc exceed the SSCLs (Table 1A; Tetra Tech 2013b; Tetra Tech 2014) at least once for each metal in the reclaimed area.

5.1.3 Upper Anaconda Mine Waste Piles – EU 1B

Three smaller mine waste pile areas further up the hillside were not addressed. These waste piles were also sampled during the RI in 2007 and 2008 to determine the metals concentrations in each pile. Arsenic, cadmium, copper, lead, and zinc exceed the SSCLs (Table 1A; Tetra Tech 2013b; Tetra Tech 2014) at least once for each metal at the waste pile areas.

5.1.4 Wetlands-based Water Treatment System (WWTS)

In 1995 and 1996, ASARCO and ARCO constructed the WWTS at the former location of the Anaconda mine (lower waste pile area) adjacent to the Blackfoot River and just downstream from the confluence of Anaconda Creek and Beartrap Creek. Original plans included a second phase of wetland cells to be built on USFS lands and to operate in series with the existing wetland treatment system, thus doubling the treatment system capacity. However, ASARCO and ARCO did not acquire the needed land and chose to complete the undersized system (ASARCO 1995). To compensate for the smaller wetlands area, ASARCO began adding a soluble organic carbon source (methanol) to the WWTS in 1999 (Hydrometrics 1999). The organic carbon addition continued through 2008, when the new WTP replaced the WWTS in 2009.

Construction of the WWTS included importing two to three feet of wetland cell substrate material (blend of Bartlett Creek borrow, limerock, and compost or peat) and four to six feet of fill material (Bartlett Creek pit-run gravel) for the cell embankments. Components of the treatment system included a 600,000 gallon oxidation/settling pond and a sand filter bed at the Mike Horse Mine for removal of iron from the Mike Horse Adit discharge (MFG 1993; Hydrometrics 1996 and 1997), an open limestone channel at the Anaconda Mine for iron removal and alkalinity generation for the Anaconda Adit/Shaft discharge (Hydrometrics 1997), and a four-cell constructed WWTS located at the Anaconda Mine that was designed to remove metals from the combined Mike Horse Adit and Anaconda Adit discharges through sulfide generation (Hydrometrics 1997). In addition, flow-through bulkhead plugs with piping and controls were installed in the Anaconda and Mike Horse adits, with the water discharge directed to the WWTS (Hydrometrics 1996 and 1997). Discharge from the treatment system entered the Blackfoot River and was permitted under the MPDES program.

Operational problems occurred at Cell 4 (Figure 4) of the WWTS in the years prior to removal of the system. Cell 4 was designed for subsurface flow to create an anaerobic environment to enhance sulfate reduction and metals removal efficiencies (Hydrometrics 2006). The problems resulted in 1) surface flow conditions in the cell, which affected system performance, and 2) increased operation and maintenance requirements (Hydrometrics 2006). Due to the aerobic conditions caused by surface flow, increasing the methanol feed rate would not improve treatment efficiency. In 2006, ASARCO completed maintenance repairs at Cell 4, including unplugging of piping at Cell 4 (Hydrometrics 2006). Nevertheless, the WWTS continued to exceed the discharge requirements of ASARCO's MPDES permit and continued to be a source of metals for the Blackfoot River. In 2009, ASARCO replaced the WWTS with the WTP to treat the Mike Horse and Anaconda adit discharge at an efficiency that would comply with the MPDES permit.

5.1.5 New Water Treatment Plant (WTP)

In 2008, in response to the BER's revocation of the temporary water quality standards, ASARCO constructed the WTP (Figure 4) to treat the Mike Horse and Anaconda adit discharges. Seep capture systems were included in the construction to treat seeps at the upper Mike Horse waste piles area, the base of the Mike Horse Repository, and next to Cell 4 (CDM 2008). The WTP operations began in January 2009 and replaced the WWTS located adjacent to the Anaconda Mine. The WTP also bypassed the Mike Horse adit pretreatment system that included the oxidation/settling pond and sand filter bed. The WTP incorporates ceramic microfiltration

technology with active chemical reagent treatment to primarily remove cadmium, copper, manganese, and zinc (CDM 2008).

The discharge point for the WTP is the same discharge/outfall that was used for the WWTS. The discharge/outfall is to the Blackfoot River at the west end of the property (Figure 4). ASARCO's permit for the WTP was a revised version of the original MPDES permit (MTR-0030031) for the WWTS. To eliminate duplication between two programs within DEQ, DEQ's Site Response Section has assumed administrative duties to monitor water quality compliance.

5.2 Capital Mine – EU 3 (1997)

The Capital Mine is a relatively small mine located in upper Stevens Gulch (Figures 3 and 5) on patented mining claims that were part of interim actions by ASARCO and ARCO in 1997 (Hydrometrics 1998). Interim actions at the Capital Mine included removal of 725 yd^3 of mine waste from the Stevens Gulch drainage bottom and placement of the waste in the Paymaster Repository (Figure1). The removal area was amended with cement kiln dust. The excavation area was regraded and revegetated, and 200 feet of stream channel reconstructed. ASARCO and ARCO did not conduct confirmation sampling at the Capital waste removal area, so it was sampled during the RI in 2007 and 2008 to assess the effectiveness of the previous actions in the area. Arsenic, copper, lead, and zinc exceed the SSCLs (Table 1A; Tetra Tech 2013b; Tetra Tech 2014) at least once for each metal.

5.2.1 Surface Water and Groundwater

Stevens Creek first surfaces intermittently above the Capital Mine site and, during some drier precipitation periods, its surface flow may terminate before reaching the main stem of the Blackfoot River. Surface water samples were collected along Stevens Creek from 1995 through 2008 (Tetra Tech 2007; Tetra Tech 2013a). Sediment and mine waste samples were collected along Stevens Creek during the RI in 2007 and 2008 (Tetra Tech 2013a).

The Capital Mine waste pile was a source of contaminated sediment to Stevens Creek. At the time of removal, the approximately 15 feet high waste pile was bisected by Stevens Creek, suggesting that the waste pile was a significant sediment loading source (MFG 1997). The RI sampling results for the Capital Mine area indicate that the waste pile was a source of arsenic, copper, lead, and zinc concentrations that exceeded the SSCLs. During the RI, numerous other mine related disturbances were also observed through stretches of the Stevens Creek channel below the Capital Mine interim action area. While these mining-related features below the Capital Mine are likely sediment sources, it appears that most of the metals present in these waste piles are below the SSCLs, with the exception of copper. The exceedances of copper are very near its SSCL, which is based on background. The copper exceedances in sediment may also be attributable to nearby exposed areas of the copper-molybdenum ore body within the Stevens Gulch drainage (Figure 14). When combined with runoff from the steep, mountainous drainage, the sediment loading in this area is likely from multiple or diffuse sources.

Surface water and streambed sediment samples were collected from seven locations along Stevens Creek (Figures 17 and 18). Sediment metals concentrations decrease from upstream, beginning at the Capital Mine, to downstream at BRSW-108 (Table 6). The decreasing arsenic, lead, zinc, and (to some extent) the copper concentrations demonstrate some natural recovery of the downstream sediments post removal of the Capital Mine waste pile. The pre and post

removal surface water data set suggests that the water quality has improved since removal of the waste pile; however, the post removal data set is limited (only two samples) (Table 7). The decreases in cadmium, copper, and lead surface water concentrations are significant when compared to pre-removal concentrations. Therefore, the removal of the Capital Mine waste pile likely removed the primary source of metals contamination that contributed to the poor water and sediment quality in the drainage. Regardless, SSCLs were exceeded in all surface water samples, except for a sample collected downgradient of the Capital Mine waste removal area (SGSW-102), which did not exceed any SSCLs. The exceedances are not protective of aquatic life, but are protective of human health.

There are no monitoring wells in the vicinity of the Capital Mine. Groundwater sampling results from one alluvial well (SGGW-101) and one bedrock well (SGGW-102) in the lower part of Stevens Gulch (Figure 17) showed no exceedances of SSCLs. The RI concluded that "water levels within SGGW-101 and SGGW-102 indicate a strong upward hydraulic gradient at this location (lower most segment of the gulch) such that bedrock groundwater is likely recharging the overlying alluvial aquifer" and confirmed "the infiltration of all the flow from the lowermost portion of Stevens Gulch into the alluvial aquifer between station BRSW-108 on Stevens Gulch and the Blackfoot River" for the sampling event (Tetra Tech, 2013a).

5.2.2 Capital Mine Adit

Also as an interim action in 1997, a grout seal was placed in the Capital Mine adit to eliminate seasonal discharge of water from the adit. The front of the adit was then collapsed, backfilled, and regraded to match the surrounding contours. A surface water sample collected from the adit flow prior to plugging exceeded DEQ-7 standards for aluminum, cadmium, copper, iron, lead, manganese, and zinc. Post-removal samples were not collected because the adit seal prevented adit discharge (Hydrometrics 1998).

5.3 Carbonate Mine – EU 4 (1993-94)

The Carbonate Mine is located at the south end of Swamp Gulch and immediately north of Highway 200 (Figure 3 and 6). For discussion purposes, the Carbonate Mine area was divided into two parts. The lower part contained waste rock, tailings, and a small tailings impoundment. The upper part included waste rock and an open mine shaft and, once removal occurred, serves as the location of the Carbonate Repository.

5.3.1 Surface Water and Groundwater

There are two surface water sampling stations (Figure 6, Table 8) located on Swamp Gulch Creek in the Carbonate Mine area. The upstream/background station is BRSW-14 and is located above all Carbonate area mining impacts. The downstream station is BRSW-15 and is located on the south side of Highway 200 at the outfall from the culvert that empties into the Upper Marsh. Surface water quality, monitored since 1991, improved following completion of waste removal in 1994. Prior to waste removal, surface water sampling directly downstream of the site at BRSW-15 showed elevated levels of total cadmium, copper, iron, manganese, lead, and zinc. Between 1995 and 1998 (the last year samples were collected), the levels for these six metals were all below DEQ-7 human health standards, but continued to have DEQ-7 aquatic standards exceedances for cadmium, copper, iron, and lead. The background station, BRSW-14, indicates

that Swamp Creek may be a source of highly mineralized water. Surface water SSCLs were exceeded for human health (lead and manganese) and aquatic life (cadmium, copper, iron, lead, and zinc). When compared to BRSW-14, all post-cleanup metals concentrations at BRSW-15 were less than those found at BRSW-14 (Hydrometrics 1995, 1996, 1997, and 1998).

There are six monitoring wells (Figure 6; one is an upgradient background well) in the lower Carbonate area that were sampled during the RI. The groundwater monitoring results showed varying trends between the shallower alluvial wells and deeper wells. One shallow well (LCMW-12S) and one deep well (LCMW-6D) exceeded the SSCLs (Table 2) for iron and/or manganese. The other three wells (LCMW-5, LCMW-6S, LCMW-12D), shallow and deep, had at least one exceedance of the SSCLs. The background well (SWGW-103) did not exceed the SSCLs for any metals (Pioneer 2015).

A conceptual site model (CSM) was prepared with the current information to better understand the groundwater at the Carbonate Mine (Pioneer 2015). The CSM indicates that while the Blackfoot River does not appear to be gaining any appreciable dissolved cadmium concentrations, the Carbonate Mine site does appear to contribute a dissolved cadmium load that is sufficient to increase the dissolved cadmium concentrations in downgradient monitoring well LCMW-1. Furthermore, once the contaminated groundwater encounters the groundwater-surface water interface, the combined dilution/dispersion/attenuation may result in approximately 80 percent reduction of dissolved cadmium concentrations (base flow cadmium (0.044 mg/L) concentration in groundwater leaving Carbonate Mine site). It is possible that additional attenuation of dissolved cadmium is occurring in groundwater, at the groundwater-surface water interface, or in the Blackfoot River (Pioneer 2015).

Although elevated levels of some of these metals continue to be present in groundwater samples, most notably at monitoring well UCMW-11 (installed post-removal) immediately downgradient of the repository, these elevated levels could be attributable to the completion of the monitoring well within the highly mineralized geologic zone (MFG 1994; Tetra Tech 2013). There is currently no evidence to indicate that the repository is a source for these metals (Pioneer 2015).

5.3.2 Lower Carbonate Area

Approximately 15,400 yd^3 of mine waste rock and tailings were removed from Swamp Gulch drainage (lower Carbonate mine area) and placed in the repository constructed at the upper Carbonate. Prior to placement into the repository, the waste was mixed with quicklime to reduce its leaching potential. The former tailings impoundment area was backfilled with borrow gravel and cover soil (13 to 17 inches deep), and the area graded to establish a wetland and meadow within the Swamp Gulch drainage (Hydrometrics 1994 and 1995; MFG 1993). ASARCO and ARCO did not conduct confirmation sampling at the lower Carbonate area, so it was sampled during the RI in 2007 and 2008 to assess the effectiveness of the previous removal actions in that area (Figure 6). Arsenic, cadmium, copper, iron, lead, manganese, and zinc exceed the SSCLs (Table 1A; Tetra Tech 2013b; Tetra Tech 2014) at least once for each metal.

5.3.3 Upper Carbonate Area

Approximately 7,500 yd^3 of mine waste rock sat within the proposed footprint for the Carbonate repository. ASARCO and ARCO incorporated this waste rock into the repository during the removals from the lower Carbonate mine area. Also addressed within the repository footprint was an open mine shaft; approximately 44 yd^3 of concrete were poured into and on top of the

open mine shaft at the Carbonate Mine before placing repository material over the top (Hydrometrics 1994).

One monitoring well, UCMW-4 (Figure 6), was drilled in the upper Carbonate area prior to construction of the repository. It was drilled to a total depth of 59 feet and never produced any groundwater (Hydrometrics 1994). The water level in the well was most recently checked in 2015.

5.3.4 Upper Carbonate Repository

ASARCO and ARCO performed the siting assessment and design for the repository in the upper Carbonate Mine area in 1993. The assessment and design considered stability, drainage, potential settlement, mine shaft remediation, infiltration/water balance (HELP modeling), acid/leachate production, erosion control, floodplain protection, and revegetation (MFG 1993).

5.4 Edith Mine – EU 5 (1995)

The Edith Mine is located just north of the Blackfoot River and west of the river's confluence with Shave Gulch (Figure 3 and 7). ASARCO and ARCO removed approximately 5,000 yd^3 of mine waste from several waste piles/waste areas in 1995 and placed them in the Mike Horse Repository. Mine waste removal areas were amended with lime-bearing material to neutralize soil acidity, and the area was seeded to promote vegetation establishment (Hydrometrics 1996). There was no confirmation sampling performed for the Edith waste piles, so they were sampled during the RI in 2007 and 2008 to assess the effectiveness of the previous actions in the area. Arsenic exceeded the SSCL once (Table 1A; Tetra Tech 2013b; Tetra Tech 2014). The nearest monitoring wells (Figure 7) are EDP-1, EDP-2, EDMW-2, and EDGW-105. Iron exceeded the SSCL at one monitoring well (EDP-2), while manganese exceeded the SSCL at two monitoring wells (EDMW-2; EDP-2; Table 2).

During the RI, samples were collected from waste in the southernmost area of the central Edith area (CEA). Concentrations of metals in this area (CEA 4) exceeded the SSCLs for several metals. However, in the FS evaluation, it was determined that CEA 4 is an area of dispersed fine tailings associated with the Blackfoot River floodplain and is being removed as a part of the EE/CA Blackfoot River floodplain removal. CEA 4 is addressed in the Action Memorandum.

5.5 Consolation Mine – EU 6 (1997)

The Consolation Mine is a relatively small mine located in lower Shave Gulch (Figures 3 and 8) on patented mining claims that were reclaimed by ASARCO and ARCO in 1997 (Hydrometrics 1998b). The Consolation Mine consisted of two collapsed adits (upper and lower) and associated mine waste piles. The mine waste occurred as a relatively thin pile covering about 2.5 total acres of hillside below the adits. ASARCO and ARCO consolidated the mine waste into the lower adit area by pushing the upper mine waste downhill into the adit, and hauling the lower mine waste pile uphill to the adit. Approximately 2,200 yd^3 of mine waste was placed into the prepped adit area, re-graded to match the surrounding topography, the upper 12 inches amended with cement kiln dust, covered with soil (12-inch minimum), and the entire removal area revegetated (Hydrometrics 1998b). ASARCO and ARCO did not conduct confirmation sampling for the Consolation Mine area, so it was sampled during the RI in 2007 and 2008 to assess the effectiveness of the previous interim actions in the area. Arsenic, cadmium, copper, lead, and

zinc exceed the SSCLs (Table 1A; Tetra Tech 2013b; Tetra Tech 2014) at least once for each metal. Monitoring wells and surface water sampling sites were never established in the immediate Consolation Mine area. However, there are downgradient surface water (SHSW-102, Figure 17) and groundwater (SHGW-101, SHGW-102; Figure 17) monitoring stations in Shave Gulch and those sampling results did not exceed SSCLs (Tetra Tech 2007, 2013a).

5.6 Mike Horse Mine – EU 8 (1993-97, 2006-07)

The Mike Horse Mine (Figures 3, 9a, and 9b) is located on Mike Horse Creek southwest of the confluence of Mike Horse and Beartrap creeks. For discussion purposes, the Mike Horse Mine area was divided into two parts. The lower Mike Horse Mine area included waste rock, debris, and the Level 300 adit and associated adit discharge of acid mine drainage, while the upper Mike Horse Mine area included numerous adits and waste rock/mine waste.

5.6.1 Surface Water and Groundwater

While showing some improvement from the interim actions, the surface water in the upper and lower mine area continues to be heavily impacted by metals. All four surface water sampling stations (BRSW-4, BRSW-4A, MHSW-101, MHSW-102; all located in the upper area, Figure 9a) exceeded at least one SSCL (Table 2) for human health or aquatic life. Exceedances for human health include cadmium, lead, and zinc, while aquatic life exceedances include cadmium, copper, lead, and zinc. Manganese also exceeded the SSCL (Tetra Tech 2013b; Tetra Tech 2014).

There are eleven monitoring wells (one is an upgradient background well) in the Mike Horse Mine area that were sampled during the RI. Four of the five wells (UMHMW-1S/D, UMHMW-2S/D) completed in the upper mine area show that groundwater is heavily impacted by mineralization and/or past mining activities (Figure 9a). The two shallow wells were completed in unconsolidated colluvium/fill material and indicate that this groundwater is a source of metals loading to Mike Horse Creek. Groundwater monitoring results for the two shallow wells exceeded SSCLs for cadmium, copper, lead, manganese, and zinc. The wells also have low to moderate pH values (3.8 to 5.9) and elevated sulfate concentrations, typically greater than 2500 mg/L (Hydrometrics 2002).

Groundwater monitoring results for the two deep wells (UMHMW-1D and UMHMW-2D) exceeded SSCLs for arsenic, cadmium, lead, manganese, and zinc. Based on physical parameters and cation analyses, the shallow and bedrock groundwater systems appear to have separate sources of recharge. The background well (MW-1; Figure 9a) did not exceed SSCLs for any metals.

MSE conducted a drilling and geologic characterization program in the upper Mike Horse drainage from 1992 through 1996 as part of a joint U.S. Environmental Protection Agency and U.S. Department of Energy bedrock grouting demonstration project (MSE 1994, 1997). The MSE investigation included drilling core holes and monitoring wells, and focused on characterization of the local bedrock groundwater system and possible interaction between it and the Mike Horse mine workings. The investigation results show that the deep groundwater is influenced by mineralization associated with the Mike Horse Fault bedrock fractures and is flowing into the Mike Horse Mine workings. Although the Mike Horse Mine workings include

more than 30,000 feet of tunnels, drifts, raises and winzes, baseflow discharges from the mine average 35 gpm (MSE 1997; Hydrometrics 2002; Tetra Tech 2007; CDM 2008).

The six wells, three shallow and three deep, completed in the lower mine area (Figure 9b) and sampled during the RI are less impacted than the upper area wells. Groundwater monitoring results for the two shallow wells (MHGW-109, MHGW-112; MHGW-115 is dry) exceeded SSCLs (Table 2) for cadmium, manganese, and zinc.

Of the three deep wells (MHMW-8, MHGW113, UMHMW-3), only one well (MHMW-8) had groundwater monitoring results that exceed SSCLs. However, the metals exceedances in groundwater at MHMW-8 suggest that the metals concentrations may be a result of the Mike Horse Repository construction. Fifteen water samples were collected from MWMH-8 starting in June 1994. The pH started at 7.7 and then dropped to 5.8 over the period 1994 to 1999. Since the first sample from MHMW-8 was the year before construction began at the 300 level and the Mike Horse Repository, it appears that there is a correlation with the construction activity and the diminishing water quality. Cadmium increased from 0.002 to 0.24 mg/L and zinc increased from 0.76 to 37 mg/L. During this period, the conductivity and the sulfate concentration also increased (Tetra Tech 2007; Spectrum 2015).

Finally, upgradient MSE well MW-1 and downgradient well UMHMW-3 meet groundwater SSCLs, which helps identify the limits of the poor quality bedrock groundwater area in the Upper Mike Horse to the vicinity of the Mike Horse and Little Nell veins (Figure 13).

5.6.2 Lower Mine Area

ASARCO and ARCO's actions at the lower mine area included removal and off-site disposal of 270 yd^3 of hydrocarbon contaminated soil along with the removal of a 1,000 gallon fuel tank, the removal of waste rock and debris from Mike Horse Creek, and the reconstruction of the Mike Horse Creek channel through the reclaimed area. The stockpiled hydrocarbon contaminated soil was tested as required for disposal at the BFI Landfill in Missoula. Four confirmation soil samples were also taken from the excavation following removal. No benzene, ethylbenzene, toluene, or xylenes (BTEX) were detected in the stockpiled contaminated soil, so BTEX analysis was not performed for the confirmation samples. The total extractable hydrocarbons concentrations in the four confirmation samples ranged from <10-36 mg/kg, below the 200 mg/kg DEQ risk-based corrective action (RBCA) screening level used at that time that would require further testing (Hydrometrics 1995 and 1996).

As previously mentioned, ASARCO and ARCO constructed the WWTS to treat drainage from the Mike Horse Adit, as well as the combined discharges from an adit and shaft at the Anaconda Mine near the confluence of the Blackfoot River and Anaconda Creek. The lower Mike Horse mine area construction associated with the WWTS included installing the flow-through bulkhead plug with piping and controls in the Level 300 adit and the 600,000 gallon oxidation/settling pond (pretreatment pond) and the sand filter bed – constructed on top of the Mike Horse Repository – for removal of iron from the Mike Horse Adit discharge (Figure 9b) (MFG 1993). In 2008, ASARCO constructed two seep capture systems that were incorporated into the design of the new WTP. One capture system is located at the toe of the repository to capture its seepage (Figure 9b) and the other system is located in the upper mine area and is designed to capture the shallow groundwater flow from the upper waste area in proximity to the Level 200 adit (Figure 9a) (CDM 2008).

5.6.3 Mike Horse Repository

Interim actions at the lower Mike Horse Mine area also included construction of a repository in 1995 and 1996. ASARCO and ARCO performed the siting assessment and design for the repository in 1994 (Figure 9b). The assessment and design considered stability, drainage, potential settlement, mine shaft remediation, infiltration/water balance (HELP modeling), acid/leachate production, erosion control, floodplain protection, and revegetation (Hydrometrics 1997 and 1998).

The Mike Horse Repository construction included a subsurface shallow groundwater collection and drainage system to maintain groundwater levels below the repository base, a limestone gravel drainage layer beneath the repository, amendment of the upper 18 inches of mine waste in the repository to limit long-term acid generation, a 12-inch growth medium layer on the repository slopes with vegetative cover, and a geosynthetic clay liner on the upper, flat repository crest (Hydrometrics 1995). The groundwater collection and drainage system was included to address water seeps that were discovered during the repository construction. Approximately 45,000 yd^3 of mine waste from the Mike Horse, Anaconda, and Edith mines were placed in the Mike Horse Repository (Hydrometrics 1996).

The Mike Horse Repository is located within the 100-year floodplain and the sampling conducted during the RI indicated that repository seeps are impacting groundwater and surface water. It was clear from information obtained in the RI that the Mike Horse Repository was inappropriately located and constructed. Removals identified in the Action Memorandum, as amended, began in 2014 and, to minimize the potential for recontamination and to maximize efficiencies and resources, waste in the same drainage (Mike Horse Creek and specific parts of the Mike Horse Mine area and the repository) and near the area that is addressed by the Action Memorandum, as amended, are also being removed as an interim action, which began in 2014 and is expected to be completed in 2016.

5.6.4 Upper Mine Area

In 1998, ASARCO and ARCO performed in-place reclamation of approximately five acres of disturbed land in the upper mine area Figure 9a). It consisted of consolidation and re-grading of mine waste to minimize surface area and limit infiltration, incorporating amendments into the mine waste to raise pH and limit the solubility of metals, placement of local borrow soil over the mine waste, construction of ditches and berms to divert storm water runoff around mine waste areas, and seeding of all disturbed areas. Re-grading of the mine waste piles and establishment of a vegetative cover was intended to reduce infiltration of rainfall and snowmelt water, and erosion of mine waste, thus improving water quality in adjacent Mike Horse Creek (Hydrometrics 1998). In 2005-2006 the in-place reclamation was followed by partial removal of mine waste from UMH-4 and UMH-5 of the same area (Figure 9a). A total of 74 confirmation samples, on a 25-foot grid, were taken and analyzed for arsenic, cadmium, copper, lead, manganese, and zinc. All analyzed metals exceeded SSCLs at least once for each metal and had a soil pH range of 4.0-8.2 (Hydrometrics 2004). Interim actions also included construction of a surface water diversion system to divert Mike Horse Creek water around the disturbed area.

5.7 Paymaster Mine – EU 9 (1996)

The Paymaster Mine was a relatively small operation that mined ore from three adits in lower Paymaster Creek drainage. ASARCO and ARCO implemented interim actions in 1996 that included waste rock removal, construction of a small wetland treatment system (Paymaster WTS) to treat a small flow from the Paymaster adit, and construction of a repository (Figures 1, 3, 10, 11, and 16).

5.7.1 Surface Water and Groundwater

Six surface water sampling stations (Figure 16) are located along Paymaster Creek. The upstream/background stations (PCSW-1, PCSW-3, PCSW-4, and PCSW-5) are located above all Paymaster Mine area mining impacts. Stations PCSW-4 and PCSW-5 are at sampling locations upstream of where the Mike Horse fault intersects Paymaster Creek (Figure 14). Stations PCSW-1 and PCSW-3 are at sampling locations located downstream of where the Mike Horse fault intersects Paymaster Creek and upstream of the historical Paymaster patented mining claims. Further downstream locations (BRSW-13 and BRSW-21) are located adjacent to the Paymaster Mine area. Location BRSW-21 is located at the upstream end of the mine area and BRSW-13 is located downstream of the mine area. The background stations upstream and downstream of the Mike Horse fault indicate that Paymaster Creek surface water quality changes through this reach. The stream pH drops from 6.0-6.9 at the upstream stations to 3.7-6.3 at the downstream stations. Iron, manganese, and zinc surface water concentrations increase downstream of the fault. DEQ-7 aquatic-life surface water standards are exceeded for copper, iron, and zinc, as well as possible exceedances (detection limits are higher than the aquatic standards) for cadmium and lead. Prior to and after the Paymaster Mine area removal, the downstream water quality changed very little. DEQ-7 aquatic-life surface water standards were exceeded for cadmium, copper, iron, lead, and zinc. Copper is the only metal to increase in concentration from BRSW-21 to BRSW-13. Except as noted in Table 9, there were no DEQ-7 human health standard exceedances for the Paymaster Creek surface water (MFG 1994, TetraTech 2007).

Within the Paymaster Mine area there are eight monitoring wells and two piezometers that were sampled during the RI (Figure 11). The eight wells (PMGW-116, PMGW-117, PMGW-118, PMGW-119, PMGW-120, PMMW-13, PMMW-14, PMMW-15) completed within the vicinity of the Paymaster Mine area show that groundwater is affected by the local mineralized geology. Groundwater monitoring results consistently show elevated levels of contaminants of concern (COCs) (aluminum, cadmium, copper, iron, lead, manganese, and zinc) in the Paymaster Mine wells and the background wells. SSCLs for cadmium, iron, and manganese were exceeded in the Paymaster wells and the background wells. Cadmium exceeded SSCLs twice, once at Paymaster Mine well PMMW-13 (0.00512 mg/L; SSCL is 0.005 mg/L) and once at background well PMGW-117 (0.00562 mg/L). Iron and manganese also exceeded the SSCLs. SSCLs for copper and manganese were exceeded at the two deep wells (PMGW-119, PMGW-120). PMGW-119 is a background well and PMGW-120 is a Paymaster Mine well. The iron SSCL was also exceeded at PMGW-120. The background piezometers (PMPZ-3, PMPZ-4) had similar elevated metals concentrations and also exceeded the SSCL for iron (Tetra Tech 2013). Based on the metal concentrations found in the shallow and bedrock wells, the water quality in the Paymaster Mine area wells is similar to the water quality in the background wells. This similarity in water quality suggests that the Paymaster Mine area groundwater is reflective of the highly mineralized background conditions.

5.7.2 Waste Pile Areas

Three distinct waste rock piles (Figures 3 and 10), totaling approximately 8,065 yd^3, were removed from the Paymaster Creek drainage bottom area. Arsenic, copper, and iron exceeded SSCLs in the 1996 confirmation samples performed for the Paymaster Mine waste pile areas. Because the sampling was limited – four samples total for the three waste pile areas – the waste pile areas were sampled again during the RI in 2007 and 2008 to assess the effectiveness of the previous actions. The two southern most waste pile areas had copper SSCL exceedances (Figure 10; EU 9A; Table 1A; Tetra Tech 2013b; Tetra Tech 2014).

The larger northern pile area (Figure 10; EU 9B) was the construction site for the Paymaster passive wetland treatment cells. During the RI, four test pits were dug through the northern cell of the wetland system substrate material and into the subsurface soil below to further evaluate the effectiveness of the 1996 waste removal. Samples were taken from the first two feet of subsurface soil at 0-6", 6-12", and 12-24" intervals for a total of three samples from each of the four test pits. Underlying soil results indicated that arsenic (181 – 1370 mg/kg) and iron (45,900 – 218,000 mg/kg) continue to exceed their respective SSCLs, while the other metals exhibited concentrations below their respective SSCLs (Tetra Tech 2013a).

In some locations, high iron concentrations, low pH, and ferricrete deposits (iron rich hardened soil layers) may be naturally occurring in Paymaster Gulch. The high iron concentrations and the compacted and almost cemented nature of some of the native material encountered in the test pits during the RI may be due to naturally occurring iron-oxide precipitation (Tetra Tech 2013a).

Groundwater that seeped out of test pit walls resulted in iron oxidation once the water encountered atmospheric oxygen. Field parameter measurements in 2007 and 2008 support that groundwater is a chemically reducing environment. A low pH was recorded in 2007, and low oxidation potential (the transfer of electrons between different chemicals determines if the water has a high or low oxidation/reduction potential) and dissolved oxygen were recorded in 2007 and 2008, all of which suggest possible reducing conditions and support field observations of rapid precipitation of iron in the test pit seeps. These observed conditions indicate that the area is likely saturated with iron in the pore water, groundwater, and soil and that oxygen in soil appears to be present at least at shallow depths below ground surface (e.g., presence of iron oxide staining and some ferricrete in test pit soils) (TetraTech 2013a).

Results for groundwater samples collected in 2007 and 2008 from the Paymaster constructed wetlands downgradient monitoring wells (PMMW-15, PMGW-120; Figure 11) indicated no detection of arsenic concentrations at or above the SSCLs. These data suggest that although the native soil horizon is enriched in arsenic (and potentially other trace metals), arsenic and other metals have likely adsorbed to or co-precipitated with iron-complexes and may also be bound to organics within the soil. The prevalence of iron (45,900-218,000 mg/kg) and organic matter in the subsurface soils actively adsorbs dissolved metals, thereby reducing impacts to groundwater. The stability of arsenic in this solid form (adsorbed to the iron) is supported by non-detect (<0.002) arsenic in all (upgradient and downgradient; Figure 11) Paymaster Gulch groundwater piezometers and monitoring wells. Future changes to the current subsurface geochemical/oxidation state conditions in the vicinity of the Paymaster Constructed Wetland system/former waste pile area will likely increase metal mobility of at least arsenic and possibly other metals (Tetra Tech 2013).

5.7.3 Paymaster Repository

ASARCO and ARCO also constructed a repository at the Paymaster Mine area in 1996 and 1997 (Figure 11). The siting assessment and design for the repository was performed in 1996. The assessment and design considered stability, drainage, potential settlement, mine shaft remediation, infiltration/water balance (HELP modeling), acid/leachate production, erosion control, floodplain protection, and revegetation. Waste from the Paymaster Mine, No. 3 Tunnel (4,955 yd^3), and Capital Mine (725 yd^3) were placed in the repository. In addition to these mine wastes, approximately 8,412 yd^3 of mine tailings from a DEQ abandoned mine reclamation project (the Big Blackfoot tailings) were placed in the Paymaster Repository. All material was fully amended with cement kiln dust to neutralize acidity and decrease metal solubility prior to placement in the Paymaster Repository (TetraTech 2007).

5.7.4 Paymaster Wetland Treatment System

Interim actions at the Paymaster Mine also included collection of a small volume of seasonal discharge from the historic Paymaster adit and treatment through the WTS, a system comprised of a pair of passive wetland treatment cells. The WTS is located adjacent to the Paymaster Mine (Figures 3 and 10), but never discharged any water during its years of operation. The WTS operation was officially discontinued in 2003 when ASARCO did not renew the WTS MGWPCS (TetraTech 2013a).

5.8 No. 3 Tunnel – EU 10 (1996)

The No. 3 Tunnel was a bulk sample adit driven by the Anaconda Company (ARCO's predecessor) for exploration of the south copper-molybdenum ore zone. ASARCO and ARCO implemented waste rock removal at the No. 3 Tunnel area in 1996 (Figures 3 and 12). Approximately 4,955 yd^3 of mine waste was removed from the No. 3 Tunnel area. All material was fully amended and placed in the Paymaster Repository. The confirmation sampling performed in 1996 was limited to one composite sample (Hydrometrics 1997 and 1998). Subsequently, the No. 3 Tunnel area was sampled again during the RI in 2007 and 2008 to assess the effectiveness of the previous actions. Arsenic, copper, iron, manganese, and zinc exceed the SSCLs at least once for each metal. There are no monitoring wells or surface water sampling sites associated with the No. 3 Tunnel area. The No. 3 Tunnel area is on federal land and is not included in this Proposed Plan.

5.9 EE/CA includes EU 2 and EU 11

As previously mentioned in the Regulatory History (Section 4), in July 2007, the USFS issued the EE/CA along with an Action Memorandum that selected the cleanup on certain federal lands within the UBMC. The Action Memorandum included: (1) total removal of the Mike Horse Dam and tailings impoundment with placement of the waste into a within-drainage repository; (2) complete removal of mine waste from Lower Mike Horse Creek and placement of the waste into a within-drainage repository; (3) removal of all concentrated and intermixed tailings from the active floodplain of Beartrap Creek and placement of the waste into a within-drainage repository; and (4) complete mine waste removal (estimated at 45,000 yd^3) from the Upper Blackfoot River and placement of the waste into a within-drainage repository (Hydrometrics 2007; USFS 2007;

Figure 23). The RI further defined the lateral extent of contamination in the Beartrap Creek floodplain (EU 11) and Blackfoot River floodplain (EU 2), which are within the USFS Action Memorandum (Tetra Tech 2013a). These two EUs serve to support the extent of removal established by the Action Memorandum. The Paymaster Repository, previously constructed by ASARCO, was identified as the preferred within-drainage repository, subject to further verification that it was a suitable location (USFS 2007).

Subsequently, several design level investigations of the Paymaster Repository area were conducted and the USFS determined that the Paymaster Repository was not suitable for placement of additional mine waste due to concerns regarding constructability, space, volume, cost, and protectiveness. Based upon those investigations, in July 2012, the USFS issued an amendment to the Action Memorandum and selected a new repository location, often referred to as Section 35. The USFS determined that Section 35 was the most protective location for a new repository and the most appropriate based upon constructability, space, volume, and cost (USFS 2012).

The construction of the UBMC (Section 35) Repository began in 2013 and the removals identified in the Action Memorandum began in 2014. Some of those areas slated for removal by the USFS also contain waste that is not solely located on USFS land. As mentioned above, to minimize the potential for recontamination and to maximize efficiencies and resources, waste in the same drainage (specific parts of the Mike Horse Mine area and repository, Figures 9a and 9b) and near the area that is addressed by the Action Memorandum (Lower Mike Horse Creek, Figure 23) is also being removed as an interim action (DEQ 2014a).

6.0 FACILITY CHARACTERISTICS

The following summarizes some of the UBMC Facility characteristics.

6.1 Climate

Climatic conditions at the UBMC are typical of intermediate to high elevation regions of the Northern Rocky Mountains with long, cold winters and short, moderately hot summers. Based on climatic records from the National Oceanographic and Atmospheric Administration's weather station at Rogers Pass (approximately two miles north-northeast of the UBMC), average monthly minimum and maximum temperatures recorded at the Rogers Pass Station average 13.4 °F in January, and 81.5 °F in July, respectively (WRCC 2011). A record cold temperature of –70 °F was recorded on January 20, 1954.

Average monthly precipitation for the period of record ranges from 0.65 inches in February to 3.10 inches in June. Annual precipitation for the period is 17.99 inches, with the highest annual precipitation (31.4 inches) occurring in 1975 and the lowest annual precipitation (13.9 inches) occurring in 1988. The greatest one-day storm event recorded since 1964 occurred on June 19, 1975, resulting in 2.98 inches of precipitation (WRCC 2011), and contributed to a cross-valley embankment failure at the Mike Horse Tailings Impoundment.

Average climatic data from the Lincoln Ranger Station weather station, located about 14 miles west of the UBMC, are similar to that from the Rogers Pass Station. This indicates that weather patterns are relatively uniform throughout the UBMC and are reasonably well represented by the Rogers Pass data (Hydrometrics 2007).

6.2 Geology

6.2.1 Regional Geology

In the area between Rogers Pass on the continental divide and the town of Lincoln, the Blackfoot River flows westward in a narrow valley parallel to US Highway 200. Along this stretch, the river has down-cut through a series of resistant bedrock ridges consisting of folded and thrust-faulted red, green and gray sedimentary mudstone units of the Precambrian Belt Formation. These units crop out in a geologic province called the southern Montana Overthrust Belt. The bedrock geologic units of the overthrust belt consist of a series of thick slabs of crustal rocks that have been sheared along low angle fault planes (thrust-faults) that moved the stacked slabs eastward over underlying rocks during the formation of the Rocky Mountains approximately 65 million years ago (Alt and Hyndman 1986).

In the Rogers Pass area, these Precambrian sedimentary units are cross-cut by granite-like (quartz-monzonitic) intrusives that are several miles in diameter and approximately 35 million years old. A number of these intrusive bodies are associated with metallic ore deposits. The Heddleston District, where the UBMC is located, is associated with one of these intrusive stocks (a stock is a term used to describe an igneous intrusion that less than 40 square miles in surface exposure). Mineralization in the Heddleston District occurs as two distinct types of deposits including:

- a number of structurally controlled high-grade, lead-zinc–silver-bearing vein-type mineralized fault and fracture structures that were mined from the turn of the century until the early 1950s; and
- a large tonnage, lower-grade disseminated intrusive hosted (porphyry) deposit of copper-molybdenum mineralization that was never developed or brought into production.

The largest and most prominent mine in the Heddleston District was the Mike Horse Mine which occurred as vein-type mineralization associated with the Mike Horse Fault zone (McClernan 1983).

6.2.2 Site Geology

The geology of the UBMC is characterized by various bedrock units, with unconsolidated materials restricted to relatively thin accumulations of alluvium along drainage bottoms. Numerous reports have been published on the local and regional geology, including Miller, et al (1973), McClave (1998), Pardee and Schrader (1933), Krohn and Weist (1977), and McClernan (1983). The following is a summary of the geology of the UBMC.

Unconsolidated Surficial Units Unconsolidated deposits within the Blackfoot drainage of the UBMC consist of glacial end moraines and stream-reworked outwash materials in the valley bottoms, and colluvial slope-wash sediments on slopes transitional between ridge crests and valley bottoms. Alluvial sediments have been contaminated with mine wastes ranging from rather thick deposits of mine tailings with lateral and vertical continuity in the upper end of the drainage below the Mike Horse tailings dam, to inter-bedded alluvial and tailings deposits, to thinner over-bank deposits in downstream and marsh locations. Ridge crests and upper flanks of ridges tend to be covered with residual, weathered-in place soils (Alt and Hyndman 1986).

Alluvial material thicknesses in groundwater monitoring wells in the UBMC range from 8 to 30 feet thick, and average about 18 feet. The shallower alluvial deposits occur at the upstream end of the valley near the Mike Horse Mine, and the thicker deposits occur near tributary stream junctions along the Blackfoot River. Unconsolidated material thickness in groundwater monitoring wells in the vicinity of the marshes and confluences of Porcupine and Meadow Creeks range from 22 to 42.5 feet thick, and average about 29 feet (Tetra Tech 2013a).

Bedrock Geologic Units Three general bedrock units are found at the UBMC, including the Belt Series Spokane Formation, a diorite sill (a tabular igneous intrusion), and a series of Tertiary-age igneous intrusive bodies (Figure 14). The Precambrian Spokane Formation includes massive, light to dark gray quartzite and argillite at the bottom, grading upward to maroon to green argillite at the top. The bedding planes dip from 5^0 to 30^0 north. The Spokane Formation is generally devoid of mineralization, except along margins of mineralized veins intruded into fractures within the argillite (Miller 1973).

The Spokane metasedimentary rocks are intruded by a flat-lying, diorite (gabbro) sill of Proterozoic age (McClave 1998). The sill is tabular in form and cuts across bedding planes of the Spokane Formation at a slight angle. The sill is well exposed in the northern two thirds of the area (upper Anaconda Creek and Shave Gulch drainages) where it reaches a thickness of 500 feet, but occurs primarily in the subsurface to the south (upper Mike Horse, Stevens, and Paymaster Creek drainages) where the thickness decreases to 200 feet due to vertical displacement by faulting. The top of the sill dips gently northward and strikes southwest-

northeast. The diorite sill contains abundant chalcopyrite (copper-iron sulfide) and pyrite (iron sulfide), with the highest copper concentrations in soils within the Heddleston District occurring above sub-crops of the diorite as opposed to above mineralized veins or ore zones (McClave 1998).

A number of igneous intrusive stocks were emplaced within the older Spokane argillite and diorite sill in the central portion of the Heddleston District (Figure 14). The igneous complex is quartz monzonite porphyry of Tertiary age. The quartz monzonite also forms linear dikes extending radially outward from the central stock, where molten rock intruded along faults and fracture zones within the country rock. Both the mineralized veins and zone of disseminated mineralization extend from south to north across the Blackfoot River drainage bottom (McClernan 1983; Figure 12).

Structure Two principal fault systems have been identified at the UBMC including the Mike Horse fault system and the Blackfoot fault system (Figure 14). Both systems trend northwest-southeast, and predate emplacement of the porphyry intrusive. The Mike Horse fault system is the southern-most of the two, and extends from east of Mike Horse Creek drainage, westward through Paymaster Creek drainage. The second fault system (the Blackfoot Fault) is located approximately 4,000 feet to the north and trends subparallel to the Blackfoot River drainage bottom (Figure 14). Both of these fault systems exhibit vertical displacements on the order of 400 feet (Miller 1973). Numerous smaller northwest-trending structures occur within the UBMC, as well as older northeast trending structures (Pardee and Schrader 1933).

Mineralization Multiple episodes of bedrock mineralization/alteration have occurred at the UBMC, with all mineralization related to the Tertiary-age intrusive complex. Early mineralization includes a network of base and precious metal veins (characterized as quartz/pyrite/chalcopyrite veins), occurring within the porphyry intrusive body and extending radially outward. These radial veins, which are typically fault controlled with considerable bedrock fracturing along vein margins, were the targets of early mine development in the district (McClernan 1983).

Imprinted upon this fault-controlled vein mineralization and surrounding bedrock are localized, disseminated deposits of supergene (mineral deposit formed near the surface) enriched copper-molybdenum mineralization (the copper-molybdenum ore zones). Two distinct copper-molybdenum ore bodies have been identified within the UBMC, including the “Number 3 Tunnel Ore Zone” located south of the Blackfoot River, and the “North Ore Zone” located north of the river (McClave 1998; Figure 14).

Area Seismicity No work has been undertaken to establish recent movement of fault structures in the UBMC. Although many of the high-angle faults shown on the UBMC geologic map (Figure 14) could be considered geologically active, most probably have very long recurrence intervals where the return period of seismic activity is on the order of thousands of years.

6.3 Groundwater

Groundwater in the UBMC has been studied in areas of known mining impacts, and predominantly along the stream valley bottoms. The general pattern of groundwater flow is from higher elevation areas, where bedrock groundwater is recharged by snowmelt and spring storm

events, towards the local drainage bottoms then along the axis of the drainage. Hydrogeology and groundwater quality are variable and appear to be site-specific or locally controlled in many areas of the UBMC. Groundwater occurs within fractured metasediments, igneous bedrock units, and within unconsolidated alluvium in drainage bottoms. Bedrock groundwater discharges to local stream drainages, recharging the alluvial groundwater system and ultimately sustaining base flow in local streams during periods of low precipitation. The recharge area of the UBMC watershed is relatively small, due to topography and proximity to the Continental Divide, and therefore annual precipitation amounts and timing significantly influence base flows in area streams (MSE 1994).

Based on invariably low yields (a few gpm or less) from bedrock monitoring wells at the UBMC, bedrock permeability is considered to be low with groundwater flow occurring predominantly through secondary fractures, joints, and fault zones. This conclusion is supported by relatively low base flow discharge (35 gpm average (CDM 2008)) from the Mike Horse Mine adit despite workings that include more than 30,000 lineal feet of tunnels, drifts, raises, and winzes. The alluvium has a much higher permeability than the bedrock due to the predominance of gravel and cobbles in the larger UBMC drainages (Beartrap Creek, Anaconda Creek, and the upper Blackfoot River; MSE 1994).

Because there is limited historical groundwater data at the UBMC, the groundwater was not classified until the RI. In accordance with ARM 17.30.1005, groundwater is classified I through IV based on its beneficial uses, and groundwater is to be classified according to actual quality or use, whichever places the groundwater in a higher class. ARM 17.30.1006 sets the standards for groundwater based upon its natural specific conductance. A review of both field and laboratory specific conductance data for the period of 2007 and 2008 indicates sampled groundwater is classified as Class I groundwater. Two specific areas, the upper Mike Horse waste pile area and the Carbonate mine area, exhibited Class II groundwater characteristics based on specific conductance. However, the groundwater in both of these areas is contaminated by mining-related activities that increase the specific conductance to a level indicative of Class II groundwater (Tetra Tech 2013a). As the lowest measured specific conductance from unimpacted groundwater determines the classification, the groundwater is Class I.

6.4 Surface Water

6.4.1 Drainage Network

The drainage network (Figure 15) in the UBMC is characterized by a dendritic pattern. Stream flow originates as snowmelt and as periodic rain events along steep upland slopes. Infiltration from these events provides base flow to streams throughout the remainder of the year. The major tributary streams in the UBMC include, from upstream to downstream, Beartrap Creek, Mike Horse Creek, Anaconda Creek, the Blackfoot River, Stevens Gulch, Shave (or Shaue) Creek, Paymaster Creek, Pass Creek, and Swamp Gulch (Figure 16). The Blackfoot River is formed by the confluence of Beartrap Creek and Anaconda Creek. Numerous tributaries of lesser significance join the Blackfoot River downstream of Swamp Gulch. Other significant surface water features include the Mike Horse Tailings Impoundment on Beartrap Creek, and a large marsh system, which begins near the confluence of the Blackfoot River and Pass Creek and extends several miles downstream. All surface waters within the UBMC are classified as B-1

waters (ARM 17.30.607), with certain identified beneficial uses that must be maintained (ARM 17.30.623).

The Blackfoot River (above Landers Fork), Beartrap Creek, and Mike Horse Creek are listed on Montana DEQ's 303(d) list as having impaired beneficial uses for aquatic life, cold water fish, and drinking water supply. Beneficial uses are identified as impaired due to the following contaminants of concern for the Blackfoot River and Beartrap Creek: cadmium, copper, iron, lead, manganese, and zinc; with the addition of aluminum for Mike Horse Creek. These contaminants are released from areas of historic mine activities and may also, in part, be related to natural background conditions (DEQ 2014a).

6.4.2 Marsh Complex and the Upper Marsh

The Upper Marsh evaluation area, a 62.3-acre wetland at the confluence of Pass Creek with the Blackfoot River (Figure 1), is part of a larger 300-acre marsh that includes the Middle Marsh and Lower Marsh. The Upper Marsh receives its largest water inputs from Pass Creek and the Blackfoot River, but also receives significant inputs from Paymaster Gulch and Swamp Gulch and a significant volume of groundwater discharge from side drainages and other wetland areas. Surface water-groundwater interaction within the Upper Marsh is complex as some portions receive input from the various water sources, while other portions lose water and recharge the aquifer during portions of the year.

Two large fens are located within the Upper Marsh at the inlets of Paymaster Creek and Swamp Gulch (Figure 19), approximately 11 and 12 acres in size, respectively. Ecologically significant because of their unique vegetation and slow rate of peat accumulation, fens require a minimum of 1,000 years for development, indicate geologic and hydrologic stability, and commonly accumulate iron, copper, manganese, and other metals. These iron-rich fen wetlands, which are typically acidic, saturated, and located at low points in the landscape or side-hill areas (Field Guide 2014), tend to be seepage-fed with an organic peat layer greater than 15 inches deep and an organic carbon content of at least 12 to 18 percent (Colorado Natural Heritage Program 2005). The fens in the Upper Marsh are located immediately downstream of the Paymaster and Carbonate ore deposits and given the time required for fens to develop, have been present in their current location well before mining practices at the UBMC. The Army Corps of Engineers, Helena Regulatory Office, considers the fens to be special aquatic sites because of their critical functions, as well as low resilience to disturbance (Geum 2013).

6.4.3 Water Rights

The Montana State Library's Natural Resource Inventory System (NRIS) database was searched for water rights information. Within the UBMC, 13 surface water right diversions are on file with priority dates ranging from 1892 to 1963. The purpose listed for all 13 rights is "mining." Eleven of the water rights were owned by ASARCO and are now owned by the Trust, one is owned by a private individual, and one is owned by the USFS (for Mike Horse Dam) (Montana State Library 2013).

7.0 FACILITY CONTAMINATION

DEQ evaluated data collected prior to the RI, during the RI, and subsequent to the RI to:

- Identify sources of contamination;
- Determine the extent of contamination in soils, groundwater, surface water, and sediment;
- Determine risks to human health and the environment; and
- Develop and evaluate cleanup options.

During the pre-RI, RI, and post-RI investigations, groundwater samples (over 600), soil samples (over 2,000 lab and XRF surface and subsurface samples), surface water samples (over 450), and sediment samples (over 200) were collected. The analytical results for these data sets were used to identify contaminants of potential concern (COPCs) in the various medium. Initially, nine out of 23 metals were identified as COPCs: aluminum, arsenic, cadmium, copper, iron, lead, manganese, mercury, and zinc (PTI 1994). Metals concentrations data for benthic macroinvertebrates, periphyton, vegetation, and small mammals were also collected for the ecological risk assessment. Eight COCs were identified in the human health and ecological risk assessments. Mercury was the only COPC, of the original nine COPCs, that was not retained as a COC. The remaining eight metals were either retained as a COC in the human health risk assessment or the ecological risk assessment, or both.

The findings of the investigations are organized by media. Details regarding contamination that is specific to the various EUs are discussed in the Preferred Remedy section (Section 11.1). Contamination found in the various media is summarized below. As discussed in the Alternatives Evaluation section (Section 10), EUs are combined into five Evaluation Areas (EAs). This streamlines the development of remedial action alternatives in the FS. The EAs and the affected media are defined as follows:

- Evaluation Area 1 (EA 1) – Upland Waste Areas (soil)
- Evaluation Area 2 (EA 2) – Groundwater
- Evaluation Area 3 (EA 3) – Streams (sediment and surface water)
- Evaluation Area 4 (EA 4) – Upper Marsh (sediment, groundwater, and surface water)
- Evaluation Area 5 (EA 5) – Mining-related Features (soil and surface water)

7.1 Groundwater

In general, groundwater (EA 2) from the Mike Horse Creek and Beartrap Creek areas (Figure 21) contained higher concentrations and more frequent exceedances of SSCLs for the analyzed metals than did samples from downgradient wells in the same drainages. SSCLs for cadmium, copper, lead, and zinc were exceeded in samples from the Mike Horse and Carbonate areas. In samples from downgradient wells in the same drainages, SSCLs for cadmium, lead and zinc were also exceeded, but only rarely (Tetra Tech 2013a).

Groundwater in the alluvial aquifer and surface water in the Blackfoot River valley and larger tributaries are connected, with the streams losing surface water to the alluvial aquifer system in some reaches and gaining water from it in other reaches. Water quality comparisons were made at five locations: upper Mike Horse Creek; lower Beartrap Creek; Blackfoot River near the Mary P Mine area; near the head of the Upper Marsh; and near the downstream end of the Upper Marsh (Figure 22), with field measurements showing higher pH and dissolved oxygen concentrations in the surface water samples. Total dissolved solids and sulfate concentrations were usually higher in the groundwater samples; in the cases where this was not true, differences in concentrations were very small (Tetra Tech 2013a).

In the upper Mike Horse Creek area, where the stream gains flow from groundwater, high metals concentrations in the groundwater are a source for the metals loads in the surface water. Cadmium, lead, and zinc exceeded SSCLs in both surface water and groundwater. For all the metals, groundwater from at least two of the four wells contained concentrations greater than those in the surface water. Near the downstream end of Beartrap Creek, also a gaining stream reach, concentrations of total dissolved solids, sulfate, and metals are substantially higher in the groundwater than in surface water, and groundwater discharges to the stream increase metals concentrations and contribute to the surface water metals load. However, comparison of bedrock groundwater quality to alluvial groundwater quality slightly upstream of this location indicates that the bedrock groundwater does not contribute to degradation of the alluvial groundwater or surface water (Tetra Tech 2013a).

At the next two locations downstream, near the Mary P Mine and the upper end of the Upper Marsh, the Blackfoot River loses water to the shallow alluvial groundwater system. In both of those areas, the surface water contains higher concentrations of cadmium and zinc than groundwater in both the alluvium and the bedrock. Near the Mary P Mine, the surface water also contains higher concentrations of lead than either source of groundwater. Near the Upper Marsh, lead concentrations in the surface water are higher than in the groundwater and copper concentrations are higher in the surface water than in one of the alluvial wells. Concentrations of cadmium and zinc in the surface water exceed SSCLs, as does lead on occasions in the shallow groundwater. Based on this information, it appears that the Blackfoot River is a source for the higher cadmium, lead, and zinc concentrations in the groundwater in these reaches (Tetra Tech 2013a).

At the most downstream location, near the lower end of the Upper Marsh, the relative concentrations between groundwater and surface water change as flow conditions change. During the fall, with low streamflow, surface water concentrations of copper, lead, and zinc were higher than in the alluvial and bedrock groundwater, but lower concentrations in the surface water during the June high streamflow reversed that trend (Tetra Tech 2013a).

Springs and seeps occur in the upper Mike Horse Creek area, in the vicinity of the Mike Horse Tailings Impoundment, and from mine adits, springs, and seeps in the UBMC. Discharge of contaminated groundwater to surface water occurs along many reaches of the Blackfoot River and its tributaries in the UBMC (Tetra Tech 2013a).

Seventeen water supply wells are listed on the Montana Bureau of Mines and Geology (MBMG) Ground Water Information Center database in the vicinity of the UBMC. Three domestic wells downstream of the Upper Marsh area and within immediate proximity of the Blackfoot River have been sampled by DEQ twice per year since March 2009. Metals concentrations in these

three domestic wells are less than SSCLs or below laboratory detection limits (Tetra Tech 2013a).

Two other domestic wells located closer to the Upper Marsh area in the vicinity of Surveyors Gulch are hydraulically connected to the Blackfoot River valley fill deposits (Tetra Tech 2013a). One well has been sampled four times, while the other well was only sampled once so far due to well operational issues. Metals concentrations in these two domestic wells are less than SSCLs or below laboratory detection limits (Portage 2014).

7.2 Soil

Surface soil (0-2 feet deep) samples were collected at known discrete upland mine waste locations that had previously undergone interim action removals (EA 1); at select mine features inventoried during the RI (EA 5); throughout the floodplains in Mike Horse Creek, Beartrap Creek, and the Blackfoot River within the UBMC (EE/CA, including EU 2 and EU 11); and at 30 locations to establish background metals concentrations for the Facility (Tetra Tech 2013a).

All nine of the EUs/discrete upland mine waste areas (EA 1; Section 11.1.1; Figure 3) had soil metal concentrations that exceeded at least one SSCL. The most frequent human health exceedances were arsenic and lead. The most frequent ecological exceedances were arsenic, copper, lead, and zinc (Tetra Tech 2013a).

Soil samples were collected from waste areas at four of the 24 mine features (EA-5, Figures 24 and 25, Appendix B) located on non-federal land. Three of those four mine features had soil metal concentrations that exceeded at least one SSCL. The most frequent human health exceedances were arsenic and lead. The most frequent ecological exceedances were copper, lead, and zinc (Tetra Tech 2013a; Pioneer 2015).

Floodplain soils (EE/CA including EU 2 and EU 11) in Mike Horse Creek, Beartrap Creek, and the Blackfoot River consistently exceeded human health SSCLs for arsenic and lead. The most frequent ecological SSCL exceedances are for arsenic, cadmium, copper, lead, manganese, and zinc (Tetra Tech 2013a).

Background samples were collected from 15 areas expected to be less mineralized and from 15 areas anticipated to have greater mineralization. Selection of the sampling locations was based on geologic maps for the area. The soil sampling results were used to calculate site-specific soil background levels. The background levels were compared to DEQ screening levels, and soil SPLP screening levels used for comparison to the leachate that is produced during the lab analysis. If the leachate exceeds the SPLP screening levels during lab analysis, it indicates that the metals concentrations in the soil may pose a threat to groundwater. All metals exhibited an exceedence of one or more screening levels for one or more samples, which indicates that some background concentrations of metals in soil may pose potential risks to human health and impair water quality (Tetra Tech 2013a).

7.3 Surface Water

In general, when seasonal (spring and fall) stream flows increased, metals concentrations decreased from upstream to downstream. Measured flows in October 2007 ranged from 0.0105 cubic feet per second (cfs) at location BRSW-4 on upper Mike Horse Creek to 5.85 cfs at

location BRSW-17 downstream of the Lower Marsh, and in June 2008 from 1.1 cfs at BRSW-4 to 92.48 cfs at BRSW-17 (Figure 17). October 2007 base flow conditions showed reaches where streamflow was lost to the shallow groundwater system near the Mary P Mine, between Stevens Gulch, Shave Gulch and the Upper Marsh, and reaches downstream of the Upper Marsh. Flow in November 2011 on the Blackfoot River along the reach between BRSW-206 and BRSW-201 ranged from 3.57 cfs at the most upstream location to 19.63 cfs at the most downstream location of the reach. Alice Creek, Hardscrabble Creek, Horsefly Creek, and Hogum Creek enter the Blackfoot River within this reach accounting for the increase in flow (Tetra Tech 2013a).

With the exception of BRSW-6 (Anaconda Creek background sample), BRSW-11 (Pass Creek background sample), BRSW-103 (Blackfoot River channel through the Lower Marsh), and BRSW-201 through BRSW-206 (between Highway 279 crossing and Hogum Creek), surface water samples exceeded at least one human health or aquatic life SSCL. The most frequent human health exceedances were cadmium, lead, and zinc. All of the human health exceedances occurred above the Upper Marsh. The most frequent aquatic life exceedances were cadmium and zinc. Ecological indicators such as diversity within the macroinvertebrate community, macroinvertebrate bioassays, and improvement in water quality from upstream to downstream suggest that the Blackfoot River is recovering below the Upper Marsh (Pioneer 2015).

The RI identified three mining-related features (BR-14, SG-71, SG-94; Figures 24 and 25), located on non-federal land, that have seeps or springs. No flow or water quality data were collected for two of the features (BR-14, SG-71). At SG-94, water emanates from an iron precipitate cone-forming spring. The metal concentrations in the spring water exceeded human health SSCLs for arsenic and iron and aquatic SSCLs for iron and zinc (Tetra Tech 2013a).

7.4 Sediment

Two different types of sediment samples were collected at the UBMC. Streambed sediment samples (i.e. sediments located beneath flowing water within active stream channels) were collocated with surface water samples and collected at 27 of 36 surface water locations sampled on the Blackfoot River and its tributaries. Marsh sediments were collected beginning from the top of the mineralized marsh sediment interface (i.e. beginning at the base of the present/existing vegetative root layer) to 2 inches, 2- to 6 inches, and 6- to 12 inches below the root layer. A total of 293 marsh sediment samples were collected from all three marsh areas (Upper, Middle, and Lower) at the UBMC.

7.4.1 Streambed Sediments

Streambed sediments (Figure 18) in the main stem of the Blackfoot River, lower Paymaster Creek, and Stevens Creek have elevated metal concentrations. The streambed data shows metal concentrations that decrease with downstream distance to the outlet of the Upper Marsh. While fluctuations in metal concentrations do occur between locations below the Upper Marsh, these concentrations are relatively constant compared to locations above the marsh. A notable exception to this observation is a distinct spike in aluminum, cadmium, copper, and manganese concentrations measured at BRSW-104 during the 2008 spring/summer sampling between the Middle and Lower Marsh, above the confluence of the Blackfoot River and Cadotte Creek. The metal concentrations in the sample taken the previous fall are much lower than the 2008 spring/summer metal concentrations and the fall sample metal concentrations are within the

range of metals concentrations found upstream of BRSW-104 to BRSW-31, just below the Upper Marsh at the Meadow Creek Bridge. According to the field notes, the BRSW-104 sampling location is characterized by swift, shallow water that flows over sand, small gravel, and cobbles. Sediment samples were difficult to collect due to the lack of fine sediment at this location. The contamination at locations below BRSW-104 continues to decrease with downstream distance, which suggests that this one sample may be anomalous as it relates to metal concentrations at the other sampling locations below the Upper Marsh (TetraTech 2013a).

Sediment samples were collected at three of the 24 mine features (Figures 24 and 25) located on non-federal land. Two of those three mine features had sediment metal concentrations that exceeded at least one SSCL. The most frequent human health exceedances were arsenic and lead. The most frequent ecological exceedances were arsenic, cadmium, copper, lead, and zinc (Tetra Tech 2013a; Pioneer 2015).

7.4.2 Marsh Sediments

The Upper Marsh has been divided into two areas: the eastern (upstream) portion at 28.0 acres and the western (downstream) portion at 34.3 acres. This division, also used in the BERA, is based on the location of an old drill road constructed within the area prior to the 1975 breach of the Mike Horse Tailings Impoundment (Figure 19). The drill road provided a containment feature for initial deposition of the tailings and sediment materials in the eastern portion of the marsh. Over time, the finer materials have been transported downstream into the western portion (Pioneer 2015).

Natural weathering of the quartz monzonite porphyry and diorite ore bodies in the mineralized areas within Pass Creek, Paymaster Gulch, and Swamp Gulch drainages (Figure 14) also contributes to the elevated COC concentrations in sediment in the Upper Marsh. The bioavailability parameters assessed in the BERA (grain size, pH, total organic carbon, and solubility) indicate with a high likelihood that lethal and sub-lethal effects to aquatic life could occur in the Upper Marsh. The pH data suggests that the metals may be bioavailable throughout the wetland, and grain size and solubility indicate that the bioavailability may be higher in the eastern (upstream) portion. Fine-grained sediment, found more commonly in the western portion of the marsh, tends to carry more organic carbon and better supports the binding of metals to the sediments. Metals in the marsh are generally more mobile and bioavailable in the medium-grained sand with lower particle surface area that is more common in the eastern portion when compared to the fine-grained sediments more common in the west (Tetra Tech 2013b).

Analytical results from sediment collected from the Upper Marsh, Middle Marsh, and Lower Marsh (Figure 20) indicate most metals analyzed exceed SSCLs. SPLP results indicate that some of these metals have the potential to migrate to adjoining sediments, surface water, and groundwater. Acid-base accounting (ABA) is an analysis that is often used, in combination with metals analysis and SPLP, to determine if a soil has the potential to mobilize or leach metals into other soils or nearby surface water or groundwater. ABA results indicated that the eastern side of the Upper Marsh has sediment that is potentially acid generating as well as the sediment in the western portion of the marsh where Swamp Gulch enters. The eastern portion of the marsh is an area where much of the tailings from the 1975 breach were deposited, and, therefore, would be expected to exhibit greater concentrations of metals, while high metal concentrations near Swamp Gulch may be a result of historical mining activities within the gulch (Tetra Tech 2013a; Tetra Tech 2013b; Pioneer 2015). The remainder of the sediment in the Upper Marsh has either

an uncertain acid generating potential or is unlikely to generate acid. No ABA analysis was performed on the Middle and Lower Marsh sediments.

The Middle Marsh and Lower Marsh sediments exhibit exceedances of SSCLs. SPLP results indicate that lead may have the potential to migrate to adjoining sediments, surface water, and groundwater. Overall, the Middle Marsh and Lower Marsh sediments exhibit lower concentrations than the Upper Marsh with the Lower Marsh exhibiting further decreases in metal concentrations. This would be expected if much of the tailings from the 1975 breach settled within the eastern portion of the Upper Marsh (Tetra Tech 2013a).

The ability of these marsh tailings sediments to generate acid and mobilize metals may be inhibited by reducing chemical conditions and overlying organic mats within the Upper Marsh. Areas that are better drained and have greater contact with atmospheric conditions have a higher potential to leach metals than those areas that are consistently saturated and have less exposure to atmospheric conditions. Organic matter within the marsh, like the peat found in the fen areas, also acts to bind the metals to the sediments, further reducing metals mobility in the environment (Pioneer 2015).

7.5 Flora and Fauna

Environmental sampling was also performed to better evaluate the ecological risks posed by potential uptake of the contaminants into the food chain. Environmental sampling included terrestrial and marsh habitats where plants, invertebrates (terrestrial and aquatic insects), and small mammal tissue were collected to evaluate contaminant transfer from one organism to another. The data was evaluated in a food chain analyses that considered the potential for transfer of metals from sediments, soils, plants, invertebrates, and small mammals to higher organisms, such as fish, predatory birds, waterfowl, and mammals (Tetra Tech 2013b).

Metal concentrations in plants, small mammals, and invertebrates were determined through laboratory analysis across three transects (high risk, moderate to low risk, and a background area) in both terrestrial and marsh habitats. For some metals, concentration levels were not detected above the laboratory method minimum detection limit. Most notably, mercury was not detected above the laboratory detection limit in any receptor in any location. Cadmium was not measured above the detection limit in any small mammal sample in the terrestrial habitat and arsenic was not detected in any small mammal or vegetation sample in the marsh habitat. For those metals that were detected, concentrations in each receptor were generally highest in the high risk transects, were at intermediate levels in the moderate to low risk transects, and were lowest in the background transects in both terrestrial and marsh habitats (Tetra Tech 2013b).

Environmental sampling was also performed in the streams to better evaluate the ecological risks posed by potential uptake of contaminants into the food chain and the overall health of the aquatic environment. Macroinvertebrate (insects living in water bodies) population and diversity analysis indicated that some sampling locations had drastic changes in macroinvertebrate populations from the two sampling periods performed during the RI. Despite the change in abundance, the calculated scores used to determine ecological health, a simple unimpaired or impaired determination, remained similar with each sampling site retaining its original determination from the first sampling event to the second event (Tetra Tech 2013).

Metal concentrations in macroinvertebrate tissue samples were determined through laboratory analysis. Most samples from the UBMC had greater metals concentrations than from the upstream background location, suggesting that invertebrates are exposed to bioavailable forms of metals in the stream and that the invertebrates are bioaccumulating metals. Based on qualitative interpretation of published tissue levels, it appears that neither cadmium nor copper tissue concentrations are high enough to exert an adverse effect on the invertebrate community. The data for lead are not adequate to support a qualitative statement of risk. However, zinc concentrations in invertebrates at the UBMC are higher than those shown to cause adverse effects in other studies (Tetra Tech 2013b).

7.6 Physical Hazards

Physical hazards that may pose a safety risk were also found during the RI and are primarily related to open adits (Appendix B). Review of field notes and available photos indicate that these features could allow human entry or present other safety hazards (Pioneer 2015).

8.0 SUMMARY OF HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENTS

DEQ evaluated risks to humans and wildlife in the baseline human health risk assessment (HHRA) (Tetra Tech 2013b) and baseline ecological risk assessment (BERA) to determine if there was any unacceptable risk for current or potential future uses (Tetra Tech 2014). The following presents a summary of the risks and the SSCLs. The HHRA and BERA identified COCs, exposure pathways, exposure assumptions, toxicity values, and calculated SSCLs protective of human health and the environment at the UBMC. Thirteen separate EUs were identified for the UBMC based on physical location, habitat type, and waste sources, as listed below:

- EU 1 – Upper Anaconda Mine Waste Removal Areas and Waste Piles
  - EU 1A – Upper Anaconda Mine Waste Removal Areas
  - EU 1B – Upper Anaconda Mine Waste Piles
- EU 2 – Blackfoot River Dispersed Tailings Associated with EE/CA Removal Action Area and Overbank Deposits
- EU 3 – Capital Mine Waste Area
- EU 4 – Carbonate Mine Waste Area
- EU 5 – Edith Mine Waste Areas
- EU 6 – Consolation Mine Waste Area
- EU 7 – Mary P. Mine Waste Pile
- EU 8 – Mike Horse Mine Waste Piles
- EU 9 – Paymaster Mine Waste Areas
  - Paymaster Mine Waste Areas Surface
  - Paymaster Mine Waste Area Subsurface
- EU 10 – Number 3 Tunnel Waste Area
- EU 11 – Beartrap Creek Dispersed Tailings Deposits Associated with EE/CA Removal Action Area, Overbank Tailings Deposits, and Flossie Louise Mine Waste Piles
- EU 12 – Marsh
- EU 13 – Stream Sediments

In addition, the HHRA compared contaminant concentrations in groundwater and surface water with DEQ-7 numeric water quality standards (DEQ 2012) for protection of human health. The BERA compared concentrations in surface water with DEQ-7 numeric water quality standards (DEQ 2012) for protection of aquatic life. Human health and aquatic life risks were not quantified for groundwater and/or surface water. Instead, for those compounds that have them, DEQ-7 numeric water quality standards are the groundwater and surface water SSCLs, unless

site-specific background exceeds the DEQ-7 numeric water quality standards in a particular location, in which case background becomes the SSCL for that location. For those compounds in groundwater and surface water for which no DEQ-7 standard exists (aluminum, iron, and manganese), DEQ calculated SSCLs or used site-specific background levels (Table 2; Tetra Tech 2014).

8.1 Future Anticipated Land Use

Current and potential future land use was evaluated as part of the HHRA and SSCLs protective of those uses were calculated. The current land use at the UBMC is primarily recreational, with industrial use at the WTP. DEQ has evaluated the reasonably anticipated future use of the UBMC by assessing the four factors found in Section 75-10-701(18), MCA: 1) local land and resource use regulations, ordinances, restriction, or covenants; 2) historical and anticipated uses of the Facility; 3) patterns of development in the immediate area; and 4) relevant indications of anticipated land use from the owner of the Facility and local planning officials. (As stated earlier, this Proposed Plan does not address any of the federal lands within the UBMC for which the USFS already determined the remedy. For those federal lands within the UBMC that were not included in the Action Memorandum, as amended, the USFS will issue a separate decision. Therefore, DEQ did not evaluate the reasonably anticipated future use of federal lands as part of this evaluation.)

1. Local land and resource use regulations, ordinances, restriction, or covenants: The Lincoln Planning Area Growth Policy (Policy) (County 2005) discusses the UBMC. It recognizes "that the Blackfoot River is one of the Lincoln Planning Area's significant environmental resources" and encourages its protection by "cooperating … in the clean-up and remediation" of the Facility.
2. Historical and anticipated uses of the Facility: Historically, the UBMC has been used for industrial (mining) and residential (housing for workers) purposes. The majority of the UBMC is open space and is currently being used for recreation. The exceptions would be industrial use at the WTP and its infrastructure, and the existing repositories located at EUs 4, 8, and 9.
3. Patterns of development in the immediate area: There has been no active development in the area and the non-federal property is surrounded by federal lands. As part of the ASARCO bankruptcy, ownership of the non-federal land at the UBMC was transferred to the Trust.
4. Relevant indications of anticipated land use from the owner of the Facility and local planning officials: DEQ sent a letter to the Trust asking for its future plans for the property. The Trust indicated that it owns 12 tracts of property and that, for tax purposes, 10 of the parcels are classified as agricultural rural, one is classified as vacant land rural, and one is classified as farmstead rural. The Trust also indicated that there are three reasonably foreseeable land use categories: parcels being used in relation to the WTP and its infrastructure or existing repositories (industrial); parcels abutting federal land that should remain forest land (recreational); and parcels abutting privately owned homestead and farmstead land that could be homestead land (recreational or residential) (Trust 2015). Of the four parcels identified by the Trust as having potential residential use, one

of them is not within the UBMC and one of them is within the UBMC only because the Blackfoot River (which is impacted) flows through the property. Portions of the other two parcels are within the UBMC. To evaluate relevant indications of anticipated land use from local planning officials, DEQ reviewed the Policy. It encourages the maintenance of open space for wildlife and promotion of existing and future recreational uses. DEQ also reviewed county zoning and determined that the UBMC is not currently subject to any county zoning (County 2015).

With the exception of the existing industrial use at the WTP and its infrastructure and the existing repositories, the other portions of the UBMC addressed by this Proposed Plan are currently being used as open space/recreational. Based upon evaluation of the four statutory factors, DEQ has identified the reasonably anticipated future uses of the UBMC as primarily open space/recreational, with the exception of the WTP and its infrastructure and existing repositories, which is industrial. Because there is no zoning to prohibit residential use and the Trust has indicated the potential for some of its property to be used as residential in the future, the reasonably anticipated future use of three parcels is recreational or residential. This is not inconsistent with the Policy and also recognizes recreational use of the UBMC may also encompass some part-time or full-time residential use.

8.2 Human Health Risks

The HHRA refers to areas directly associated with UBMC contaminant sources (that is, historical mining areas where contaminants originated) as on-site EUs (EUs 1, 3, 4, 5, 6, 7, 8, 9, and 10). Affected areas located downstream from historical mining areas are referred to as off-site exposure units (EUs 2, 11, 12, and 13). This distinction is made only to assist DEQ in developing SSCLs for different EUs within the UBMC and its use is limited to this purpose because, under CECRA, the "facility" includes "any site or area where a hazardous or deleterious substance has been deposited, stored, disposed of, placed, or otherwise come to be located." For all other purposes, the term "on-site" includes all suitable areas in close proximity to the contamination necessary to implement the remedial action.

When evaluating receptors for risk assessment purposes only, a distinction is made for those areas where contamination may have originated (on-site) and those areas where contamination has migrated from those sources (off-site). In the HHRA, it was assumed that land use at the UBMC consisted of recreational (current/future on- and off-site fishermen, hunters, rock hounds, ATV/motorcycle riders), commercial/industrial (current/future on-site and future off-site), construction/utiltity worker (current/future on- and off-site) and residential (future on-site and current/future off-site). Although residential land use was limited to off-site areas in the HHRA, potential future on-site residential use was also evaluated in the HHRA because there are no current restrictions at the Facility limiting residential use.

Populations that could potentially be exposed to contamination at UBMC include future residents, current and future commercial/industrial workers, current and future construction workers, current and future recreators, and current and future ecological receptors. Trespassers were not evaluated separately as the recreator evaluation would be protective of any potential trespassers because the recreator assumptions consider more potential contact with contaminants than trespasser assumptions.

In the HHRA, DEQ calculated exposure scenario- and exposure pathway-specific risks. Potentially complete exposure pathways for soil and sediment at the UBMC are incidental ingestion, dermal contact, and inhalation of COCs released to outdoor air. The HHRA evaluated these pathways for all receptors (Table 10; Tetra Tech 2014). In addition, the HHRA evaluated exposure to COCs from ingestion of fish for the recreational fisherman. The risk equations used in the HHRA incorporated chemical-specific exposure point concentrations, exposure scenario- and pathway-specific assumptions, and chemical-specific toxicity criteria to calculate cancer risks and noncancer hazards. To ensure protection of human health, DEQ developed cleanup levels based on cumulative risk levels less than or equal to a total excess cancer risk of one in 100,000 ($1X10^{-5}$) for carcinogens and a total hazard index less than or equal to 1 for non-carcinogens.

Lead was identified as a COC in surface soil, subsurface soil, or sediment at EUs 1, 2, 3, 4, 5, 6, 7, 8, 11, and 12. Health effects from exposure to lead, particularly in children, may occur at such low blood lead levels that use of threshold-based toxicity criteria to evaluate potential risks from exposure to lead is not preferred. Rather, SSCLs for lead were developed using blood lead modeling with a blood lead level of 10 micrograms per deciliter (µg/dL). DEQ also included a SSCL for lead based on 5 ug/dL because the U.S. Centers for Disease Control and Prevention (CDC) recently indicated that adverse health effects are documented at blood lead levels of 5 µg/dL. This provides two separate lead SSCLs based on both current U.S. Environmental Protection Agency (EPA) and new CDC guidance on lead effects. Detailed discussion of the blood lead modeling methodology is included in Appendix E of the HHRA (Tetra Tech 2014). See Section 8.8 for a discussion of the SSCL selection process. All of the SSCLS for the UBMC are found in Tables 1A, 1B, and 2.

DEQ also identified applicable background concentrations for the COCs. These data were also used for developing SSCLs.

Finally, DEQ developed SSCLs that are protective of groundwater. Site-specific dilution attenuation factors (DAFs) and SPLP results from each EU were used to develop SSCLs that are protective for the conditions found in the specific EU. Initially, the DAFs for each EU were obtained from the RI (Tetra Tech 2013a). However, after reviewing the leaching-to-groundwater SSCLs, EU soil metals concentrations, and EU groundwater data, it was noted that while the metals concentrations in groundwater were often below SSCLs, the soil metals concentrations often exceeded the leaching-to-groundwater SSCLs. This review suggested that some of the leaching-to-groundwater SSCLs developed using the RI DAFs may be too conservative. Using DEQ guidance for developing SSCLs, site-specific DAFs were determined for each EU. A decision key was then developed that used a four-step progression that moved from the simplest to the most complex process for identifying a leaching-to-groundwater SSCL. Additional discussion regarding this process is found in Section 8.7. The development of the soil leaching-to-groundwater SSCLs is discussed in detail in Section 10.4 in the HHRA (Tetra Tech 2014).

8.3 Ecological Risks

The UBMC BERA characterizes ecological risks posed to plants, invertebrates, fish, birds, and mammals within the UBMC. Comparisons of soil, sediment, and surface water concentrations with screening criteria are supplemented by additional lines of evidence in the BERA. Because ecological receptors are not exposed to groundwater until it is discharged to surface water or

sediment, groundwater is not evaluated in the BERA. Risk estimates are based on food chain models, toxicity information in the literature, benthic community assessment data, and consideration of the frequency and magnitude of chemical detections at the UBMC.

Risk-based remedial ecological goals are concentrations in environmental media that correspond to a specific, acceptable target risk or hazard level when an ecological receptor contacts the contaminated medium according to a defined exposure scenario (Table 11; Tetra Tech 2013b). The following present the methodology used to develop the risk-based remedial ecological goals for plants, terrestrial invertebrates, fish and aquatic invertebrates, and birds and mammals.

Risk-based remedial ecological goals for EUs 1 through 13 were calculated for all birds and mammals evaluated in the BERA using methods consistent with EPA guidance (EPA 1997). Instead of inputting a sample soil concentration and calculating a dose, the risk-based remedial goal was calculated by setting the hazard quotient equal to 1.0 and then solving for the soil concentration. This process is known as back-calculating.

Twelve vertebrate (birds and mammals) receptors were selected as representative of the taxonomic groups and feeding guilds expected to occur in the EUs. The 12 vertebrate receptors and their feeding guilds are American Dipper (insectivore), Great Blue Heron (carnivore), Morning Dove (herbivore), Red-Tailed Hawk (carnivore), American Kestrel (insectivore), Meadow Vole (herbivore), White-Tailed Deer (herbivore), Red Fox (carnivore), Masked Shrew (insectivore), Canada Goose (herbivore), Mallard (omnivore), Muskrat (herbivore), and Mink (carnivore). Other receptor groups included plants, terrestrial invertebrates, and fish and aquatic invertebrates. Representative receptors were based on species known to occur in Lewis and Clark County and on recommendations of local wildlife and fisheries experts from Montana Department of Fish, Wildlife, and Parks. The development of these ecological remedial goals is discussed in detail in the BERA (Tetra Tech 2013b).

8.4 Determination of COCs and Cleanup Levels

DEQ determined which COCs should be retained from the list of contaminants of potential concern (COPCs) presented in the RI Report. Because metals are typically found in soils, DEQ also considered site-specific background concentrations in selecting COCs. The primary COCs for UBMC include: aluminum, arsenic, cadmium, copper, iron, lead, manganese, and zinc.

All of the UBMC COCs are metals, which are made available for mobilization as products of sulfide mineral oxidation. The oxidation of sulfide in mine waste and tailings generates acid and releases metals. Once freed from the mineral structure, metals and acidity can become mobile, leach from sources (mine wastes, tailings, sediment, and exposed ore deposits), and then be transported via acidic water to receiving streams and to the groundwater system. Infiltration of storm water (including snowmelt) and leaching of contaminants may also contribute to contaminant transport from primary sources into subsurface soils (Tetra Tech 2014). Health effects of the COCs are discussed below.

8.4.1 Aluminum

The Agency for Toxic Substances and Disease Registry (ATSDR) has indicated that the consumption of foods containing aluminum-containing food additives is a major source of aluminum in the diet. The use of other consumer items such as antiperspirants, cosmetics,

internal analgesics (buffered aspirins), anti-ulcerative medications, antidiarrheals, and antacids that also contain aluminum compounds will result in exposure to aluminum. Exposure to aluminum is usually not harmful, but exposure to high levels can affect your health. Breathing large amounts of aluminum dusts can cause lung problems or decreased performance in some tests that measure functions of the nervous system. Some people with kidney disease sometimes develop bone or brain diseases which may be caused by the excess aluminum. It is not known for certain whether aluminum causes Alzheimer's disease. The Department of Health and Human Services (DHHS) and the EPA have not evaluated the carcinogenic potential of aluminum in humans. Aluminum has not been shown to cause cancer in animals (ATSDR 2008).

The bioavailability and toxicity of aluminum is associated with pH; aluminum is soluble and biologically available in acidic soils (pH less than 5.5), but is biologically inactive in circumneutral to alkaline (pH 5.5 to 8) conditions. The effects of aluminum on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion regarding aluminum and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.4.2 Arsenic

ATSDR has indicated that arsenic combines with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Inorganic arsenic compounds are mainly used to preserve wood. Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting low levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingesting very high levels of arsenic can result in death. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans. Long-term exposure to arsenic in children may result in lower IQ scores (ATSDR 2007a). The bioavailability and toxicity of arsenic depend on the chemical and physical forms of arsenic, the exposure route, and the species of concern. The effects of arsenic on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion regarding arsenic and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.4.3 Cadmium

ATSDR has indicated that cadmium used in the United States typically is extracted during the production of other metals like zinc, lead, and copper. It is used in many different applications including batteries, pigments, metal coatings, and plastics. Breathing high levels of cadmium can severely damage lungs. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones. The DHHS and IARC have determined that cadmium and cadmium compounds are human carcinogens. Cadmium may also affect children during periods when organs are developing (ATSDR 2012a).

The bioavailability and toxicity of cadmium depend on the exposure route and the species of concern. The effects of cadmium on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion

regarding cadmium and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.4.4 Copper

ATSDR has indicated that copper is used to make many different kinds of products like wire, plumbing pipes, and sheet metal. Copper is also combined with other metals to make brass and bronze pipes and faucets. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics. Low levels of copper are essential for maintaining good health. High levels can cause harmful effects such as irritation of the nose, mouth and eyes, vomiting, diarrhea, stomach cramps, nausea, and even death. It is not known whether copper can cause cancer in humans (ATSDR 2004).

Copper is an essential trace mineral nutrient and is a dietary requirement for most animals in daily doses between 8 and 17 mg/kg-day. However, it becomes toxic to all organisms at higher doses (ATSDR 2004). The effects of copper on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion regarding copper and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.4.5 Iron

Iron is naturally occurring and the most abundant metal present in the Earth's crust and core. Iron is mined in the United States and is used to make steel, wrought iron, and other metal alloy products. The production and use of iron compounds for use as catalysts, pigments, and drugs, and for use in agriculture, nutrition, metallurgy, and leather tanning, can result in releases to the environment from human activities. Iron is necessary for good health and can be absorbed by the oral, inhalation, and dermal routes of exposure. Very large doses, however, can be harmful. In humans, ingestion of milligram to gram quantities may cause gastrointestinal effects with symptoms such as nausea, diarrhea, vomiting, constipation, heartburn, bloating, abdominal pain, and epigastric pain. Acute doses in the range of 200 to 400 milligrams per kilogram (mg/kg) may be fatal (EPA 2006). No suitable bioassays or epidemiological studies are available to assess the carcinogenicity of iron. EPA, therefore, has not assigned iron a weight-of-evidence cancer guideline description for human carcinogenicity (EPA 2006).

Iron was not evaluated in the BERA because no ecological toxicity benchmarks are available for iron. It is not considered a priority pollutant by EPA (Tetra Tech 2013b).

8.4.6 Lead

ATSDR has indicated that lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. The IARC has determined that inorganic lead is probably carcinogenic to humans and that there is

insufficient information to determine whether organic lead compounds will cause cancer in humans (ATSDR 2007b).

Lead is neither essential nor beneficial to living organisms, and all data show that its metabolic effects are adverse. Lead is a mutagen (causes mutations that are often cancerous) and a teratogen (causes birth defects). The effects of lead on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion regarding lead and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.4.7 Manganese

ATSDR has indicated that manganese occurs naturally in most foods and may be added to some foods. It is used principally in steel production to improve hardness, stiffness, and strength. It may also be used as an additive in gasoline to improve the octane rating of the gas. Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food. At high levels, it can cause damage to the brain. The EPA concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer (ATSDR 2012b).

Manganese is an essential element and ecological receptors response to manganese differs widely. The effects of manganese on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion regarding manganese and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.4.8 Zinc

ATSDR has indicated that zinc is found in air, soil, and water, and is present in all foods. Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. Low levels of zinc are essential for maintaining good health. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. The DHHS and the IARC have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity (ATSDR 2005).

Zinc is an essential trace element for all living organisms, and zinc deficiency can be a problem for both plants and animals. Ecological receptors response to zinc toxicity differs widely. The effects of zinc on aquatic plants, terrestrial plants, aquatic invertebrates, terrestrial invertebrates, fish, birds and mammals were assessed in the BERA. A discussion regarding zinc and its effects on ecological receptors is found in the BERA (Tetra Tech 2013b).

8.5 Human Health COCs

Arsenic and lead were identified in the HHRA as the only soil or sediment human health COCs at the UBMC. The soil leaching-to-groundwater COCs are aluminum, arsenic, cadmium, copper, iron, lead, manganese, and zinc. However, the background soil concentrations for some metals in

EUs 1-11 are greater than some of the human health and leaching-to-groundwater SSCLs. When the background concentrations are greater, they will be used as SSCLs (Table 1A).

The DEQ-7 human health water quality standards are the applicable cleanup levels for groundwater and surface water, unless site-specific background exceeds the DEQ-7 numeric water quality standards in a particular location, in which case background becomes the SSCL for that location. For COCs without a DEQ-7 human health standard available (aluminum, iron, and manganese), the HHRA evaluated and established SSCLs. The groundwater and surface water SSCLs are provided in Table 2.

In the groundwater, the alluvial water-bearing zone (WBZ) COCs are aluminum, arsenic, cadmium, copper, iron, lead, manganese, and zinc. The deeper bedrock WBZ COCs are aluminum, cadmium, copper, iron, lead, manganese, and zinc. In the surface water, the COCs are cadmium, lead, manganese, and zinc.

8.6 Ecological COCs

In the BERA, arsenic, cadmium, copper, lead, manganese, and zinc were evaluated for all receptors in all EUs. The remaining COCs were addressed as follows:

- Aluminum was assumed to pose an unacceptable risk wherever soil pH was less than 5.5.
- Mercury was not evaluated because it was not detected at any EU by either XRF 10 or by standard laboratory methods. However, mercury was detected at a single stream sediment sample from the abandoned mine feature survey. Additional sampling of stream sediments by DEQ did not detect mercury beyond this single sample.
- Iron was not evaluated because no screening benchmarks are available for soil, sediment, or the food chain model.

The risk-based remedial ecological goals are included in the BERA for birds, mammals, plants, terrestrial invertebrates, fish and aquatic invertebrates. The ecological receptor with the lowest risk-based remedial ecological goal at a given EU is the most sensitive receptor. Remedial goals for the most sensitive receptors are expected to be protective of all ecological receptors exposed to soils or sediments within an EU. The masked shrew was identified as the most sensitive receptor to all soils and sediments COCs in EUs 1-12. However, the background soil concentrations for EUs 1-11 are greater than the risk-based remedial ecological goals. Therefore, none of the risk-based remedial ecological goals will be used as SSCLs (Table 1A). For the sediment in EU12, cadmium is the only COC that has a risk-based remedial ecological goal for an SSCL; the remaining SSCLs are derived from background concentrations (Table 1B). In EU13 the arsenic, cadmium, copper, lead, and zinc risk-based remedial ecological goals are the SSCLs (Table 1B) for streambed sediment.

The DEQ-7 aquatic water quality standards are the applicable cleanup levels for surface water (which, in most cases, are more conservative than the human health water quality standards), unless site-specific background exceeds the DEQ-7 aquatic water quality standards in a particular location, in which case background becomes the SSCL for that location. Manganese does not have an aquatic standard and iron only has a chronic aquatic standard. Cadmium,

copper, lead, and zinc aquatic standards are expressed as a function of total hardness (mg/L as calcium carbonate (CaCO3)). Because these metals require a total hardness analysis to calculate the aquatic standard, hardness data will need to be collected at the time of sampling to demonstrate compliance with aquatic surface water SSCLs. The surface water SSCLs are provided in Table 2.

In the surface water, the COCs are cadmium, copper, iron, lead, and zinc.

8.7 Chemical Fate and Transport Model

As part of the UBMC HHRA, DEQ performed chemical fate and transport modeling to develop SSCLs for the soil leaching-to-groundwater pathway. Leaching-to-groundwater SSCLs for each EU were derived using site-specific DAFs and SPLP results from each EU.

As a result of the complexity of the behavior of metals, leaching tests are used to quantify the partitioning and mobility of metals in site soils. DEQ developed the leaching-to-groundwater SSCLs based on the availability and characteristics of the SPLP results for each EU. The site-specific DAF can be applied to several potential methods, based on guidance provided by DEQ, for developing a groundwater SSCL (DEQ 2014). The availability and characteristics of the SPLP results for each EU determined which method was used to identify the leaching-to-groundwater SSCL. First, EU soil metal concentrations were compared to background metal concentrations. If all EU soil metal concentrations are less than the background soil metal concentration, then background becomes the leaching-to-groundwater SSCL. Background is also the SSCL if an EU does not have any SPLP results. If EU soil metal concentrations exceed background, then the SPLP data is arranged in a tabular format and compared to the soil metals concentrations in that EU. If all the EU soil metal concentrations are less than or equal to the highest qualifying soil concentration (QSC), then the QSC becomes the leaching-to-groundwater SSCL. Finally, if the soil metal concentrations are greater than site-specific background and greater than the QSC, then the leaching-to-groundwater SSCL is determined by using a site-specific distribution coefficient value.

Documentation of the development of leaching-to-groundwater SSCLs is provided in Section 10.4 and Appendix G of the HHRA (DEQ 2014).

8.8 Site-Specific Cleanup Levels

Once the human health risk-based concentrations were calculated for HHRA COCs and the risk-based remedial ecological goals were calculated for the BERA COCs, they were compared to the site-specific background concentrations for the UBMC. If the site-specific background concentrations exceeded the human health risk-based concentrations and the risk-based remedial ecological goals, then the background concentrations were selected as the SSCLs. Table 1 provides the SSCLs and its origin (risk-based concentration, risk-based remedial ecological goal, soil leaching to groundwater, or background concentration). All of the SSCLs in Table 1 are based upon either site-specific background concentrations or leaching-to-groundwater and are not risk-based concentrations. Because site-specific background levels were higher, in most cases, than the human health risk-based concentrations and the risk-based remedial ecological goals, the site-specific background levels were selected as the SSCLs. Site-specific background

levels were chosen because it is not necessary to cleanup to a soil metals concentration that is lower than the background concentration.

9.0 PRELIMINARY REMEDIAL ACTION OBJECTIVES

DEQ established preliminary remedial action objectives (PRAOs) to allow the identification and screening of remedial alternatives that will achieve protection of public health, safety, and welfare and the environment.

The PRAOs for solid media (mine waste, tailings, soil, and sediment) include:

- Prevent exposure of humans to COCs in solid media at concentrations greater than SSCLs.
- Prevent exposure of ecological receptors to COCs in solid media at concentrations greater than SSCLs.
- Reduce ecological risks to levels that will result in the recovery and maintenance of healthy local populations and communities of plants and animals.
- Prevent migration of COCs from solid media to groundwater and surface water that would result in exceedances of SSCLs.
- Meet SSCLs for COCs in soil and sediment.
- Comply with environmental requirements, criteria or limitations (ERCLs).

The PRAOs for water media (surface and groundwater) include:

- Meet groundwater and surface water SSCLs for COCs.
- Reduce potential future migration of contaminated groundwater.
- Prevent exposure of humans or ecological receptors to COCs in groundwater or surface water at concentrations greater than SSCLs.
- Comply with ERCLs.

10.0 SUMMARY AND EVALUATION OF ALTERNATIVES

The FS (Pioneer 2015) describes the alternatives evaluated to cleanup soil and sediment, groundwater, and surface water at the UBMC. These alternatives are summarized and evaluated in the following sections using the remedy selection criteria provided in Section 75-10-721, MCA:

Protectiveness Overall protection of public health, safety, and welfare and the environment addresses whether an alternative provides adequate protection in both the short-term and the long-term from unacceptable risks posed by hazardous or deleterious substances by eliminating, reducing, or controlling exposure to protective levels.

Compliance with ERCLs This criterion evaluates whether each alternative will meet applicable or relevant state and federal ERCLs. Preliminary ERCLs are included in the FS (Pioneer 2015). Final ERCLs will be identified in the ROD.

Mitigation of Risk This criterion evaluates mitigation of exposure to risks to public health, safety, and welfare and the environment to acceptable levels.

Effectiveness and Reliability Each alternative is evaluated, in the short-term and the long-term, based on whether acceptable risk levels are maintained and further releases are prevented.

Practicability and Implementability Under this criterion, alternatives are evaluated with respect to whether the technology and approach could be applied at the UBMC.

Treatment or Resource Recovery Technologies This criterion addresses use of treatment technologies or resource recovery technologies, if practicable, giving due consideration to engineering controls. These technologies are generally preferred to simple disposal options.

Cost Effectiveness Cost effectiveness is evaluated through an analysis of incremental costs and incremental risk reduction and other benefits of the alternatives considered. This analysis includes taking into account the total anticipated short-term and long-term costs, including operation and maintenance (O&M) activities.

The first two criteria, protectiveness and compliance with ERCLs, are threshold criteria that must be met in order for a remedy to be further considered or selected. The next five criteria are balancing criteria that DEQ evaluates to obtain the best balance in selecting the remedy. These criteria also consider present and reasonably anticipated future uses of the UBMC as well as institutional controls (ICs). In addition to these criteria, DEQ will consider the acceptability of the preferred alternative to the affected community, as indicated by community members and local government, during the public comment period on this Proposed Plan. After the public comment period ends, DEQ will consider relevant information, including but not limited to any comments submitted during the public comment period, and determine whether any necessary revisions to the preferred remedy are appropriate.

The cost estimate for each alternative is based on present worth estimates of capital and O&M costs for a specific time period. The costs are developed using environmental costing software and vendor information. The types of costs that are assessed include the following:

- Capital costs, including both direct and indirect costs
- Annual O&M costs, including long-term effectiveness monitoring cost
- Periodic costs
- Implementation of ICs
- Net present worth of capital, O&M costs, periodic costs, and implementation of ICs

Detailed cost estimates for each alternative are included in Appendix A. A summary of costs for each alternative is provided in Table A-1 of Appendix A. The cost estimates in the FS include costs for both private lands and federal lands not already addressed in the Action Memorandum, as amended, at the UBMC. The costs applicable to private land and federal land are not separated in Section 10 of the Proposed Plan but will be separated when DEQ issues the ROD. However, Section 11 of the Proposed Plan contains cost only applicable to private lands for which DEQ is identifying the preferred remedy.

When groundwater modeling predictions or experience related to a specific alternative was available, that information was considered in estimating cleanup timeframes and is discussed in each alternative description below. The cost estimates are based on the assumption that the alternatives will meet the estimated cleanup timeframes and these are preliminary estimates only. They are used to ensure that the costs of each alternative are compared and evaluated based upon consistent information. Actual costs and cleanup timeframes may vary and cost estimates will be further refined during remedial design.

Two of the alternatives originally retained for consideration in the FS have not been considered for further analysis:

- Physical Hazards/Solid Media – Ex-situ Treatment - Blending and Co-Disposal. Initially this alternative was considered most applicable as a design consideration for the blending of waste within an on-site or off-site repository (Pioneer 2013). However, further analysis of this alternative indicated that there were no locations where it would be advantageous to blend and co-dispose of wastes (Pioneer 2015).
- Groundwater/Surface Water – Engineering Controls – Detention. This alternative would involve temporarily storing water in a pond and releasing it slowly, with the goal of removing suspended sediment to improve water quality. Further analysis of this alternative suggests that, for groundwater, this technology would offer no benefit for water quality since there is no effect on dissolved COCs. For small surface water flows (i.e., adit discharges) it would not be desirable to release the flow downstream from a detention area. For larger surface water flows (i.e., streams) the size of a pond required to offer any benefit to water quality would not fit within the UBMC topographic constraints. Therefore, there are no locations where it would be advantageous to use detention (Pioneer 2015).

10.1 Alternatives Evaluation

EUs, as discussed in Section 5, were combined into five Evaluation Areas (EAs) to streamline the development of remedial action alternatives in the FS. Remedial action alternatives specific to each EA are provided in Tables 12-1 through 12-5 and Appendix A. These tables include

information that pertains to both private and federal land. DEQ's preferred remedy reflects only the actions and costs associated with private land and is further described in Section 11. Also, as discussed earlier, EU2 and EU11 are within the Action Memorandum, as amended, and, therefore, the USFS has already selected the remedy for those areas and they are not evaluated further here. EU10, portions of EU 5 and EU 7, and several abandoned mine features are on federal land and the USFS will select the remedy for those areas. The EAs and the affected media are defined as follows:

- Evaluation Area 1 (EA 1) – Upland Waste Areas (soil)
- Evaluation Area 2 (EA 2) – Groundwater
- Evaluation Area 3 (EA 3) – Streams (sediment and surface water)
- Evaluation Area 4 (EA 4) – Upper Marsh (sediment and water)
- Evaluation Area 5 (EA 5) – Mining-related Features (exploratory adits, drill pads, etc.)

EA 1 Evaluation Area 1 (Figure 3, shows all EU locations) includes the following:

- Upper Anaconda Mine Waste Area (EU 1A)
- Upper Anaconda Mine Waste Piles (EU 1B)
- Capital Mine Waste Area (EU 3)
- Carbonate Mine Waste Area (EU 4)
- Edith Mine Waste Area (only that portion not on federal land) (EU 5)
- Consolation Mine Waste Area (EU 6)
- Mary P Mine Waste Area (only that portion not on federal land) (EU 7)
- Mike Horse Mine Waste Area (EU 8)
- Paymaster Mine Waste Area Surface (EU 9A)
- Paymaster Mine Waste Area Subsurface (EU 9B)

EA 2 Groundwater is evaluated in EA 2 and includes the following features (Figures 9b, 11, 21, and 22)

- Anaconda Mine Adit Discharge (vicinity of EU 1A/EU 1B)
- Carbonate Mine (vicinity of EU 4) Groundwater
- Mike Horse Mine (vicinity of EU 8) Adit Discharge and Seeps
- Upper Mike Horse Mine (vicinity of EU 8) Bedrock Aquifer
- Paymaster Gulch Aquifers (vicinity of EU 9A/EU 9B)

EA 3 Surface water and its associated streambed sediment are evaluated in EA 3 (Figures 16, 17, and 18) and include the following features:

- Blackfoot River from the inlet of the Upper Marsh downstream to the confluence with Hogum Creek (EU 13) and the reach of the Blackfoot River that runs through the Upper Marsh (EU 12).

- Paymaster Creek, Shave Creek, Stevens Creek, and an unnamed tributary to the Blackfoot River above the WTP.
- Discharges, seeps, or springs identified at mining-related features along the Blackfoot River and within the Paymaster Gulch, Pass Creek, Shave Gulch, and Stevens Gulch drainages.

EA 4 Sediments, surface water and groundwater are evaluated in the Upper Marsh (only that portion not on federal land) (Figures 2, 19 and 20).

EA 5 Twenty-four mining-related features (Figures 24 and 25; Appendix B) were identified during the RI, although the majority of the features were not sampled as part of the RI. (This number does not include mining-related features on federal lands which are outside this Proposed Plan.) Four of these had open adits, which pose a potential physical safety hazard. In addition, the FS assumes that the observed mine waste, disturbed areas, discharges, seeps, or springs at these features exceed the SSCLs for the closest and most applicable EU.

10.2 Site-Wide Elements

All remedial alternatives, except No Action, have common elements. These common elements are described here and are not repeated in the description of alternatives that follow. These include:

- ICs - Deed Restrictions, Easements, Covenants, Reservations or a Controlled Groundwater Area
- Engineering Controls
- Long-term Monitoring and Maintenance

ICs – Deed Restrictions, Easements, Covenants, Reservations or a Controlled Groundwater Area

ICs are defined in Section 75-10-701(11), MCA, as restrictions placed upon real property to mitigate the risk to public health, safety and welfare, and the environment. They include such things as: a) deed restrictions; b) easements; c) reservations; d) covenants, either restrictive or affirmative; and e) other mechanisms or restrictions for controlling present and future land use, such as a controlled groundwater area. ICs do not remediate the contamination, but can be effective for managing human exposure to contaminants. The effectiveness of ICs depends on the mechanism used and the durability of the IC. ICs may be layered to improve effectiveness. They are considered easy to implement and inexpensive to implement and maintain, although long-term enforcement may increase costs. At the UBMC, ICs could include a restrictive covenant prohibiting residential use, limiting groundwater use until it meets SSCLs, or prohibiting excavation in areas of capped or contained waste. It could also include a controlled groundwater area limiting groundwater use until it meets SSCLs.

For purposes of this proposed plan, the estimated cost of implementing an IC is approximately $5,000, including attorney and filing fees, and it is assumed that five ICs will be necessary for a total cost of $25,000 (Appendix A, Table A-1). This estimate does not include the cost of enforcing violations of the IC, reporting compliance with ICs, or the cost of additional remediation that may be necessitated by a violation of an IC.

Engineering Controls

Engineering controls are measures that help manage environmental and health risks by reducing contamination levels or limiting exposure pathways. Engineering controls encompass a variety of engineered remedies such as fencing to contain and/or reduce exposure to contamination and/or physical barriers intended to limit access to property. Although engineering controls do nothing to remediate the contamination, they can be effective for managing exposure to contaminants. The effectiveness of engineering controls depends on the mechanisms used and the durability of the engineering control. The initial cost of some engineering controls can be high, and generally engineering controls require some long-term maintenance. Engineering controls at the UBMC may include access restrictions such as the installation of fencing, gates, and posting of signage.

Fencing and gates provide some short-term protection from unacceptable risks for public health and safety by limiting physical access to contaminated soil or physical hazards, such as subsidence. Protection would depend on the durability of the control and compliance from the general public, regular monitoring, and maintenance. Access restrictions would be most effective for areas with solid media impact. Fencing and signage is less effective for surface water due to the dynamic nature of the streams and difficulty in fencing a floodplain.

For purposes of this proposed plan, the estimated cost of the access restrictions includes constructing fencing and installing gates and warning signs and is $507,514 (Appendix A, Table A-1).

Long-term Monitoring and Maintenance

Monitoring is a common element to all remedial alternatives except No Action. However, the monitoring requirements may vary for each remedial alternative. The general objectives of monitoring are to evaluate the effectiveness of the remedy, to determine when SSCLs are achieved, and to ensure the ongoing protection of public health, safety and welfare and of the environment. Long-term monitoring has two key components: long-term monitoring and performance monitoring. Long-term monitoring is independent of remedial alternatives and is used to evaluate the nature and extent of the groundwater plumes. Performance monitoring is specific to individual remedial alternatives and is used to evaluate the effectiveness of the remedy. Details of the required long-term monitoring will be developed after the ROD is issued.

At present, a long-term monitoring program for the UBMC includes semiannual sampling of an existing groundwater monitoring well network of seven wells and inspections at the Paymaster and Carbonate Repositories (which include but are not limited to vegetative cover and integrity inspections).

For proposed plan cost estimation purposes of this site-wide element, the existing monitoring program is expanded to include surface water monitoring at six locations along the Blackfoot River and at the Carbonate Mine, inspection of the UBMC Repository, and inspections at areas within the UBMC where waste is treated in place. It also includes periodic inspections and maintenance of adit plugs. Monitoring costs for the WTP are included in the cost estimate for that alternative. Long-term monitoring and maintenance costs are calculated for a period of 30 years. Performance monitoring, if required, is included with the applicable alternative and not as a site-wide element. The estimated cost of long-term monitoring and maintenance is $1,979,427 (Appendix A, Table A-1).

Site-Wide Elements Cost Estimate

Costs associated with these common elements are provided in Appendix A (Table A-1). The net present value for the site-wide elements is $2,511,941.

10.3 **Remedial Alternatives**

The remedial alternatives were evaluated by solid media (which includes soil, sediment, and physical hazards) and liquid media (which includes groundwater and surface water). The FS included an initial screening of alternatives, which included an analysis of known alternatives for each media (Pioneer 2013). As part of the FS, remedial alternatives that could reasonably be expected to work at the UBMC were evaluated. Additional screening of these alternatives in the FS resulted in further evaluation of one baseline alternative (no action) that may be applied to both solid and liquid media, seven alternatives for solid media, and seven alternatives for liquid media, which include:

Solid Media and Liquid Media:

- Alternative 1: No Action

Solid Media:

- Alternative 2: Monitored Natural Recovery (MNR)
- Alternative 3: Physical Barriers
- Alternative 4: Containment
- Alternative 5: Removal and On-site Disposal
- Alternative 6: Removal and Off-site Disposal
- Alternative 7: In Situ Neutralization with Alkaline Amendment
- Alternative 8: Ex situ Neutralization with Alkaline Amendment

Liquid Media:

- Alternative 9: Monitored Natural Attenuation (MNA)
- Alternative 10: Containment (Retention Pond)
- Alternative 11: Hydrologic and Hydraulic Control
- Alternative 12: Inundation
- Alternative 13: Active Chemical Reagent
- Alternative 14: Active Physical/Mechanical Treatment
- Alternative 15: Passive Chemical Reagent: Permeable Reactive Barrier (PRB)

These technologies are discussed in detail in the FS and are summarized below.

10.3.1 Alternative 1 – No Action

Under the no action alternative for both solid and liquid media, all identified contamination remains at the UBMC and continues to impact soil, groundwater and surface water quality, and environmental receptors. Operation of the WTP is discontinued and there is no further monitoring of the existing repositories. Contaminants could become more mobile under

hydrological changes such as flood events, changes in the stream channel, or drying of the currently flooded areas due to loss of beaver activity. COCs would remain mobile in the environment with potential accumulations in the food chain.

Protectiveness - This alternative does not provide any protection from unacceptable risks in either the short-term or long-term for human health or the environment. All contaminated media remains in place and SSCLs would continue to be exceeded. Although the saturated conditions that currently exist have reduced the mobility of metals in the marsh, the COCs would continue to be taken up within the food chain and contaminated sediments could be subject to erosion if a large flood occurs or beaver activity is significantly reduced.

Compliance with ERCLs - Since all contamination remains in place under this alternative and taking into account the nature of the contamination, contaminated soil and sediment would continue to impact groundwater and surface water. Groundwater and surface water would not comply with applicable ERCLs and compliance with ERCLs would not be achievable within any timeframe.

Mitigation of Risk - There is no mitigation of exposures to risk under this alternative. SSCLs continue to be exceeded site-wide.

Effectiveness and Reliability - There is no short-term or long-term effectiveness or reliability in maintaining acceptable risk levels under this alternative.

Practicability and Implementability – This alternative could be easily implemented site-wide at the UBMC.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $0 (Appendix A, Table A-2).

10.3.2 Alternative 2 – Monitored Natural Recovery (Sediments)

MNR is a remedy for contaminated sediment that typically uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. Under the MNR alternative, contaminated sediments are regularly monitored to track changes in COC concentrations with time after source removal or upstream control actions. MNR relies on the mixing and isolation of contaminants through natural sedimentation processes without active treatment (EPA 2005) and is applicable to areas within EA 3 (Table 12-3), and EA 4 (Table 12-4). For marsh sediments, present inundated conditions have helped to immobilize the metals; however, the COCs are still being taken up within the food chain and are subject to mobilization under high flow events. Loss of beaver activity could result in dewatering of the inundated areas and result in increased contaminant mobility and availability throughout the Upper Marsh. Although surface water concentrations meet DEQ-7 standards for humans, concentrations upstream of State Highway 279 would continue to exceed standards for aquatic life until natural recovery reduces levels to SSCLs. Performance monitoring would be conducted to measure the success of upstream source removals.

Protectiveness - This alternative provides no protection from unacceptable risks in the short-term for public health and safety or welfare or the environment, but may become protective

over the long-term. SSCLs will continue to be exceeded within sediment until concentrations decrease through natural recovery processes. The effectiveness of MNR would largely be determined by the success of source removal or upstream control actions.

Compliance with ERCLs - Under this alternative, contamination remains in place at concentrations exceeding SSCLs and may serve as a continuing source to groundwater, surface water and other receptors in the short-term. However, combined with successful upstream removal actions, and based on experience at other similar sites such as Silver Bow Creek near Butte, Montana, compliance with surface water ERCLs may be achieved within 30 to 40 years. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination.

Mitigation of Risk - There is little to no immediate mitigation of exposures to risk under this alternative. Contaminants left in place at concentrations exceeding the SSCLs may become more mobile under hydrological changes such as flood events, channel erosion, or dewatering of the currently flooded marsh areas due to loss of beaver activity. COCs would remain mobile within the food chain as well until concentrations are naturally reduced over time. Monitoring could be used to identify areas that have recovered sufficiently.

Effectiveness and Reliability – This alternative by itself is not an effective remedy for limiting human exposure. There is no effectiveness or reliability in protection of the environment, nor protection of human health downstream. This alternative can be effective and reliable when combined with other source control or removal actions.

Practicability and Implementability - This alternative could be easily implemented at the UBMC in areas where adequate upstream source control or removal was performed. Access to the existing monitoring points would remain the same or similar to current conditions. This alternative is practicable and implementable at the UBMC.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $2,545,823 (Appendix A: Table A-2). Cost details and calculations for this alternative are included in Appendix A: EA3 – pp 4-5 and EA4 – pp 2-3.

10.3.3 Alternative 3 – Physical Barriers (Physical Hazards)

Under this alternative, adit openings or related physical safety hazards associated with mining-related features (EA 5) Table 12-5 would be closed using a physical barrier to prevent human entry. Installation of a bat gate, plugging with foam or a bulkhead, or backfilling would eliminate the open adit hazard at PC-01. This alternative only addresses the physical safety hazards associated with open adits.

Protectiveness –This alternative is protective of public safety associated with open adits because the openings would be closed to prevent human entry.

Compliance with ERCLs – This alternative only addresses the physical safety hazards associated with open adits. There are no ERCLs applicable to this alternative. The remedy would be designed to ensure adequate revegetation, cover materials, and maintenance of any structures used to prevent entry.

Mitigation of Risk – By eliminating purposeful or accidental access to the adit opening or related physical safety hazards, risks to public safety would be mitigated under this alternative.

Effectiveness and Reliability – This alternative involves proven technology that is effective and reliable in the short- and long-term for eliminating access to open adits or other related physical safety hazards. Adit closure has been used to limit access at other mining-related features at the UBMC and other mining sites with success.

Practicability and Implementability - Adit closure is a standard mining construction practice. A physical barrier could be easily implemented at the PC-01 mining-related feature under this alternative.

Treatment or Resource Recovery Technologies – This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $193,845. Cost details and calculations for this alternative are included in Appendix A: EA5 – pp 4-5.

10.3.4 Alternative 4 – Containment (Soil and Marsh Sediment)

Under this alternative, solid media (soil and marsh sediment) would be contained by covering with vegetated cover or rock to eliminate risk of direct exposure, reduce sediment migration and limit water infiltration. Containment is applicable to areas within EA 1 (Table 12-1), EA 4 (Table 12-4), and EA 5 (Table 12-5).

Protectiveness – This alternative would eliminate the potential for direct contact with contamination, stabilize the exposed surfaces of waste rock or impacted soil with respect to migration of impacted sediment to surface water, and slow or reduce the infiltration of precipitation. This alternative would significantly reduce direct exposure to contamination and would reduce to some extent the leaching of contamination to groundwater. However, it may not be protective of human health and the environment in the short-term and long-term by itself because contamination would remain in place at concentrations exceeding soil leaching to groundwater SSCLs and could serve as a continued source of contamination to groundwater.

Compliance with ERCLs - Under this alternative, contamination remains in place at concentrations exceeding protection of groundwater SSCLs and may serve as a continuing source to groundwater. Depending on conditions at the source area, groundwater and surface water may not achieve applicable ERCLs within any timeframe due to a fluctuating groundwater table or other continuing migration of contamination. In areas where waste is not in contact with surface water or groundwater, compliance with surface water and groundwater ERCLs may be achieved within 30 to 40 years, due to the reduction in infiltration provided, based on experience at other similar sites such as Silver Bow Creek near Butte, Montana. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination. The remedy would be designed to ensure adequate revegetation and cover material that meets reclamation ERCLs.

Mitigation of Risk – Containment provides some mitigation of the risks to human health and the environment. While the risk posed by direct contact with the contamination may be

reduced, contamination left in place at concentrations exceeding the soil leaching to groundwater SSCLs may continue to leach to groundwater, and therefore this alternative does not adequately mitigate risk to human health and the environment.

Effectiveness and Reliability – This alternative provides adequate short-term effectiveness and reliability in limiting contact with contamination. Short-term water quality impacts to the surrounding environment could occur at those sites where construction of roads or re-grading of waste occurs close to surface water. Construction best management practices (BMPs) would be employed to effectively reduce adverse short-term impacts on surface water from the construction activities. Containment may be susceptible to weathering and erosion, reducing the long-term effectiveness and reliability of the cover. O&M would be required to maintain the integrity of the cover.

Practicability and Implementability – The grading, placement of soil or cover, and revegetation steps required for containment are considered standard and conventional construction practices. Engineering and construction contractors with the experience and equipment necessary to complete the work are available regionally. This alternative is practicable and implementable at the UBMC

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $16,064,459. Cost details and calculations for this alternative are included in Appendix A: EA1 – pp 5-7, EA4 – pp 4-5, and EA5 – pp 6-8.

10.3.5 Alternative 5 – Removal and On-site Disposal (Soil and Sediment)

Under this alternative all solid media (soil and sediment) exceeding the SSCLs would be removed, transported, and disposed of at an engineered on-site repository. Removal is applicable to areas within EA 1 (Table 12-1), EA 3 (Table 12-3), EA 4 (Table 12-4), EA 5 (Table 12-5).

Protectiveness – The removal and disposal of contaminated solid media would eliminate the waste sources and provide protectiveness for human health and the environment. In areas of impacted groundwater and/or surface water, this alternative would eliminate the continuing source, allowing groundwater and/or surface water quality to improve. Removal of marsh sediments will require disturbance of large areas of the sensitive wetland ecosystem.

Compliance with ERCLs – Since the contamination exceeding the SSCLs is removed, there is no continuing waste source that could impact groundwater and surface water. Therefore, in areas where groundwater and surface water standards are currently met, this alternative would achieve ERCLs immediately. In locations of impacted groundwater and/or surface water, compliance with surface water and groundwater ERCLs may be achieved within 30 to 40 years, when combined other alternatives or through attenuation, based on experience at other similar sites such as Silver Bow Creek near Butte, Montana. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination. In addition, the repository would be sited in an area that complies with ERCLs and would be designed and constructed to comply with solid waste ERCLs, including a minimum of 24 inches of cover material. The remedy would be designed to ensure adequate revegetation and cover material that meets relevant reclamation ERCLs.

Mitigation of Risk - Removal and proper disposal of contamination at concentrations exceeding the SSCLs provides mitigation of the risks to human health and the environment.

Effectiveness and Reliability – This alternative is considered highly effective and reliable in both the short-term and long-term. Short-term water quality impacts to the surrounding environment could occur at those sites where construction of roads and excavation of waste occurs close to surface water or in the marsh. Construction BMPs would be employed to effectively reduce adverse short-term impacts on surface water and the marsh from the construction activities.

Practicability and Implementability – The excavation and disposal of wastes and revegetation steps required for removal are considered standard and conventional construction practices. Construction and reclamation of upland wastes and mining-related features could be difficult in some locations at the UBMC because of the steep terrain, remoteness, and inadequate access, and special equipment may be required. Removal of sediment in the marsh and streams is dependent upon dewatering operations and access into wet or saturated areas. Mike Horse Creek Road and an abandoned drill testing road provide the only serviceable access to the Upper Marsh. Certain stream reaches are difficult to access because of steep terrain, remoteness, and inadequate roads in these areas. Engineering and construction contractors with the experience and equipment necessary to complete the work are available regionally. While this alternative is practicable and implementable at the UBMC, removal would be difficult in certain locations for the reasons stated.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness - The cost estimate assumes that the on-site disposal location is the UBMC (Section 35) repository since the USFS already selected the Section 35 repository in its Action Memorandum, as amended, and that repository has been constructed. Since the USFS already selected that repository and it is currently being constructed under the Action Memorandum, as amended, costs associated with construction of the repository are not included with the on-site repository estimates. If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $23,436,793. Cost details and calculations for this alternative are included in Appendix A: EA1 – pp 8-10, EA3 – pp 6-9, EA4 – pp 6-7, and EA5 – pp 9-11.

10.3.6 Alternative 6 – Removal and Off-site Disposal (Soil and Sediment)

Under this alternative all solid media (soil and sediment) exceeding the SSCLs would be removed, transported, and disposed of at an engineered off-site repository. Removal is applicable to areas within EA 1 (Table 12-1), EA 3 (Table 12-3), EA 4 (Table 12-4), and EA 5 (Table 12-5).

Protectiveness –The removal and disposal of contaminated solid media would eliminate the waste sources and provide protectiveness for human health and the environment. In areas of impacted groundwater and/or surface water, this alternative would eliminate the continuing source, allowing groundwater and/or surface water quality to improve. Removal of marsh sediments will require disturbance of large areas of the sensitive wetland ecosystem.

Compliance with ERCLs – Since the contamination exceeding the SSCLs is removed, there is no continuing waste source that could impact groundwater and surface water. Therefore,

in areas where groundwater and surface water standards are currently met, this alternative would achieve ERCLs immediately. In locations of impacted groundwater and/or surface water, compliance with surface water and groundwater ERCLs may be achieved within 30 to 40 years, when combined other alternatives or through natural attenuation, based on experience at other similar sites such as Silver Bow Creek near Butte, Montana. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination. In addition, the repository would be sited in an area that complies with ERCLs and would be designed and constructed to comply with solid waste ERCLs, including a minimum of 24 inches of cover material. The remedy would be designed to ensure adequate revegetation and cover material that meets relevant reclamation ERCLs.

Mitigation of Risk - Removal and proper disposal of contamination at concentrations exceeding the SSCLs provides mitigation of the risks to human health and the environment.

Effectiveness and Reliability – This alternative is considered highly effective and reliable in both the short-term and long-term. Short-term water quality impacts to the surrounding environment could occur at those sites where construction of roads and excavation of waste occurs close to surface water or in the marsh. Construction BMPs would be employed to effectively reduce adverse short-term impacts on surface water and the marsh from the construction activities.

Practicability and Implementability – The excavation and disposal of wastes and revegetation steps required for removal are considered standard and conventional construction practices. Construction and reclamation of upland wastes and mining-related features could be difficult in some locations at the UBMC because of the steep terrain, remoteness and inadequate access, and special equipment may be required. Removal of sediment in the marsh and streams is dependent upon dewatering operations and access into wet or saturated areas. Mike Horse Creek Road and an abandoned drill testing road provide the only serviceable access to the Upper Marsh. Certain stream reaches are difficult to access because of steep terrain, remoteness, and inadequate roads in these areas. Engineering and construction contractors with the experience and equipment necessary to complete the work are available regionally. While this alternative is practicable and implementable at the UBMC, removal would be difficult in certain locations for the reasons stated.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness - The cost estimate assumes that the off-site repository location is the State Section 18 site. This site was selected to represent the off-site repository location because it is the nearest, potentially suitable state-owned property (Pioneer 2011). If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $29,625,091. Cost details and calculations for this alternative are included in Appendix A: EA1 – pp 11-13, EA3 – pp 10-13, EA4 – pp 8-9, and EA5 – pp 12-15.

10.3.7 Alternative 7– In Situ Neutralization with Alkaline Amendment (Soil)

Under this alternative, all solid media exceeding the SSCLs would remain in place, but the pH of the soil would be increased through the application of lime, and the mobility and bio-availability of metals within the soil reduced. Concentrations of metals in the soil are unchanged. In-situ

neutralization is applicable to waste deposits less than two feet in thickness, or treatment of residual soil contamination in previously reclaimed areas within EA1 (Table 12-1) and EA-5 (Table 12-5).

Protectiveness – This alternative can be protective for human health and the environment by reducing the bioavailability of the metals to environmental receptors. While this alternative would reduce the leaching of contamination to groundwater, it may not be protective of human health and the environment in the short-term and long-term by itself because contamination would remain in place at concentrations exceeding soil leaching to groundwater SSCLs.

Compliance with ERCLs - Under this alternative, contamination remains in place at concentrations exceeding soil leaching to groundwater SSCLs. In areas of impacted groundwater or surface water, compliance with surface water and groundwater ERCLs may be achieved within 30 to 40 years, when combined with other alternatives or through natural attenuation, based on experience at other similar sites such as Silver Bow Creek near Butte, Montana. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination below the treatment zone. The remedy would be designed to ensure adequate revegetation and cover material that meets relevant reclamation ERCLs.

Mitigation of Risk - In-situ neutralization provides some mitigation of the risks to human health and the environment. While the risk posed by direct contact with the contamination may be reduced, contamination would be left in place at concentrations exceeding the soil leaching to groundwater SSCLs, and therefore this alternative does not adequately mitigate risk to human health and the environment.

Effectiveness and Reliability - This alternative provides adequate short-term effectiveness and reliability in limiting contact with contamination and reduces leaching to groundwater. Short-term water quality impacts to the surrounding environment could occur at those sites where construction of roads, re-grading of waste, and treatment occurs close to surface water. Construction BMPs would be employed to effectively reduce adverse short-term impacts on surface water from the construction activities.

Practicability and Implementability - The grading, lime incorporation and revegetation steps required for in-situ neutralization are considered standard and conventional construction practices. Construction may be moderately difficult because of the steep terrain and remoteness of some locations and may require special equipment. Incorporation of lime requires specialized equipment and expertise and will require additional sampling and investigation to determine proper liming rates at each location. A suitable off-site source of lime is required and will involve hauling of this material on public roads. This alternative is practicable and implementable at the UBMC to waste deposits less than two feet in thickness, or treatment of residual soil contamination in previously reclaimed areas. While this alternative is practicable and implementable at the UBMC, neutralization would be difficult in certain locations for the reasons stated. This technology was used during interim remedial actions at the UBMC, in combination with containment.

Treatment or Resource Recovery Technologies - This alternative relies on the treatment technology of alkaline amendment of soil, which raises the pH of the amended material, thus reducing the mobility of the metals.

Cost Effectiveness - If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $4,311,101. Cost details and calculations for this alternative are included in Appendix A: EA1 – pp 14-16 and EA5 – pp 16-18.

10.3.8 Alternative 8 – Ex-situ Neutralization with Alkaline Amendment (Soil)

Under this alternative, all soil exceeding the SSCLs would be excavated, mixed with lime, and returned to the original excavation site. Ex-situ neutralization is applicable to areas within EA1 (Table 12-1) and EA-5 (Table 12-5).

Protectiveness – This alternative can be protective of human health and the environment by reducing the bioavailability of the metals to environmental receptors. While this alternative would reduce the leaching of contamination to groundwater, it may not be protective of human health and the environment in the short-term and long-term by itself because the contamination would remain in place at concentrations exceeding soil leaching to groundwater SSCLs.

Compliance with ERCLs - Under this alternative, contamination remains in place at concentrations exceeding soil leaching to groundwater SSCLs. In areas of impacted groundwater or surface water, compliance with surface water and groundwater ERCLs may be achieved within 30 to 40 years, when combined other alternatives or through natural attenuation. Although not used at similar sites such as Silver Bow Creek near Butte, Montana, the technology supporting this alternative is the same as in-situ neutralization and similar results in achieving ERCLs are expected. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination. The remedy would be designed to ensure adequate revegetation and cover material that meets relevant reclamation ERCLs.

Mitigation of Risk - Ex-situ neutralization provides some mitigation of the risks to human health and the environment. While the risk posed by direct contact with the contamination may be reduced, contamination would be left in place at concentrations exceeding the soil leaching to groundwater SSCLs, and therefore this alternative does not adequately mitigate risk to human health and the environment.

Effectiveness and Reliability - This alternative provides some short-term effectiveness and reliability in reducing leaching to groundwater. Short-term water quality impacts to the surrounding environment could occur at those sites where construction of roads, excavating, mixing, and handling of waste occurs close to surface water. Construction BMPs would be employed to effectively reduce adverse short-term impacts on surface water from the construction activities. This alternative may be more effective when combined with other alternatives.

Practicability and Implementability - The excavation, lime incorporation, mixing, replacing, and revegetation steps required for ex-situ neutralization are considered standard and conventional construction practices. Construction may be moderately difficult because of the steep terrain and remoteness of some locations and may require special equipment. Incorporation of lime requires specialized equipment and expertise and will require additional sampling and investigation to determine proper liming rates at each location. A suitable source of lime is required and will involve hauling of this material on public roads.

This alternative is practicable and implementable at the UBMC to large areas of previous interim actions that exceed SSCLs. In small areas were treatment cannot be contained within the footprint of the identified area exceeding SSCLs, removal of waste and mixing of lime may possibly impact surrounding areas, increasing the volume of material requiring treatment. In larger areas, removal and mixing could be performed within the footprint of the identified area exceeding SSCLs, minimizing impacts.

Treatment or Resource Recovery Technologies - This alternative relies on the treatment technology of alkaline amendment of soil, which raises the pH of the amended material, thus reducing the mobility of the metals.

Cost Effectiveness - If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $2,317,210. Cost details and calculations for this alternative are included in Appendix A: EA1 – pp 17-19.

10.3.9 Alternative 9 – Monitored Natural Attenuation (Groundwater)

Under the MNA alternative, groundwater is regularly monitored to track changes in COC concentrations with time after source removal. MNA relies on dilution, sorption, and/or dispersion without active treatment and is applicable to areas within EA 2 (Table 12-2) and EA 4 (Table 12-4). The site-wide monitoring element tracks the overall effectiveness of remediation and does not include the monitoring for MNA at specific locations that may vary with time depending on the success of source removal and other site-specific factors. For purposes of developing cost estimates, it was assumed that MNA monitoring would include the existing wells at each of the groundwater locations plus an additional 5 wells. MNA monitoring would last for approximately 30 years. The monitoring would begin on a semi-annual basis and continue for 10 years. It would finish with annual monitoring for the final 20 years. Monitoring for this alternative could be effectively combined with the site-wide long-term monitoring to reduce costs.

Protectiveness -This alternative provides no protection from unacceptable risks in the short-term for human health or the environment. When combined with other alternatives, it can provide long-term protection for public health, safety, and welfare and the environment, although it is a slow natural process. The effectiveness of MNA would largely be determined by the success of source removal or control actions.

Compliance with ERCLs - Based on experience at other similar sites such as Silver Bow Creek in Butte, Montana, compliance with groundwater ERCLs through natural attenuation may be achieved within 30 to 40 years, when combined with source removal. This timeframe could vary due to a fluctuating groundwater table or other continuing migration of contamination. However, based on this experience and engineering judgment, and depending on conditions at the source area and successful removal of source materials, compliance with applicable ERCLs for groundwater may not be achieved for 50 years at certain areas of the facility due to mineralized geology in the bedrock aquifer, presence of mine workings, a fluctuating groundwater table or other continuing migration of contamination. Natural attenuation processes, in association with source removal, will act to reduce mass, toxicity, mobility, volume, or concentrations of COCs in groundwater.

Mitigation of Risk - There is little to no immediate mitigation of exposures to risk under this alternative alone. Contaminated groundwater remains in place, untreated, and may continue to migrate off-site. Depending on subsurface geology and geochemistry, the mechanisms for reducing concentrations of the inorganic COCs are complex and difficult to predict with any certainty.

Effectiveness and Reliability – This alternative by itself is not an effective remedy for limiting human exposure. There is no effectiveness or reliability in protection of the environment, or protection of human health at or downgradient of contaminated groundwater. This alternative can be effective and reliable when combined with other source control or removal actions.

Practicability and Implementability - This alternative could be easily implemented at the UBMC. Access to the existing monitoring points would remain the same or similar to current conditions. This alternative is practicable and implementable at the UBMC.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $2,311,332. Cost details and calculations for this alternative are included in Appendix A: EA2 – pp 2-3 and EA4 – pp 10-11.

10.3.10 Alternative 10 – Containment (Retention Pond – Seeps and Springs)

Under the containment (retention pond) alternative, seeps and springs (surface water) associated with certain mining-related features would be captured and stored in a retention pond. Retention relies on evaporation and infiltration without active treatment and is applicable to mining-related features areas within EA 3 (Table 12-3) because of the limited volume of contaminated water associated with the mining-related features. It would not apply to contaminated streams and rivers because the volume of contaminated water is too great and the space to construct a retention pond to contain large volumes of water is limited.

Protectiveness - This alternative would provide a means of containing impacted surface water and preventing migration beyond the area of the retention pond. This alternative would significantly reduce direct exposure to contamination downstream of the retention pond. However, it may not be protective of human health and the environment in the short-term and long-term by itself because contamination would remain in place at concentrations exceeding SSCLs and could serve as a source of exposure to human health and the environment in the retention area.

Compliance with ERCLs – Under this alternative, contamination remains in place at concentrations exceeding SSCLs. Depending on conditions at the source area, surface water from the source area (e.g., seep or adit discharge) and the retention pond may not achieve applicable ERCLs because of continuing inputs of contamination. Based on engineering judgment and review of guidance documentation from the “National Menu of Stormwater Best Management Practices” (EPA 2015), surface water downstream of the retention pond may comply with ERCLs following implementation of the remedy in combination with other alternatives, such as upstream source removal and natural attenuation.

Mitigation of Risk – Exposures to risk in the vicinity of the surface water discharge would not be mitigated by retention as the water at concentrations exceeding the SSCLs may remain on the surface and become concentrated within the retention pond. Downstream of the pond, however, risk exposure would be mitigated through the containment of the contaminated seep or spring (surface water).

Effectiveness and Reliability – Containment of water in a retention pond will reduce the extent of impacts causing human and ecological exposure to the contaminants. Retention must retain the entire volume of water to be effective, and therefore higher flow rates require larger areas. Retention ponds may be susceptible to erosion and other damage, reducing the long-term effectiveness and reliability of the alternative. O&M would be required to maintain the integrity of the remedy and ensure continued performance as designed.

Practicability and Implementability –The excavation, filling, lining, grading, and revegetation steps required to construct a retention basin are considered standard and conventional construction practices. Construction at some of the mining-related features could be difficult in some locations at the UBMC because of the steep terrain, remoteness and inadequate access, and special equipment may be required. Engineering and construction contractors with the experience and equipment necessary to complete the work are available regionally. While this alternative is practicable and implementable at the UBMC, retention would be difficult in certain locations for the reasons stated.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness - If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $1,116,380. Cost details and calculations for this alternative are included in Appendix A: EA3 – pp 14-16.

10.3.11 Alternative 11 – Hydrologic and Hydraulic Control (Groundwater and Surface Water)

Under this alternative, clean upgradient groundwater and surface water at the Carbonate Mine site (EA 2; Table 12-2) would be captured and diverted around the waste removal area. While this alternative would reduce the quantity of groundwater impacted by metals, it would not reduce the quantity of metals leaving the Carbonate Mine site, and therefore is not anticipated to reduce the impact of the Carbonate Mine site on downgradient groundwater and surface water quality. If used in conjunction with other alternatives, this alternative could reduce the volume of contaminated water requiring treatment, thereby reducing long-term costs.

Protectiveness – This alternative would not significantly reduce the contribution of metals from the Carbonate Mine site and does not provide protectiveness for the short-term and long-term for human health or the environment. Protectiveness may be met if combined with other alternatives.

Compliance with ERCLs –Since mine workings would continue to generate groundwater with concentrations exceeding SSCLs that would continue to migrate downgradient of the Carbonate Mine site, contaminant sources to groundwater would remain in place. With this alternative alone, it is reasonable to assume compliance with groundwater ERCLs will not be achievable in any timeframe in downgradient groundwater based on engineering judgment.

However, when combined with other treatment alternatives, such as passive treatment (PRB) at the Carbonate site, compliance with ERCLs for downgradient groundwater would be achievable following implementation of the PRB within 5 to 10 years.

Mitigation of Risk - There is no mitigation of exposures to risk to human health and the environment under this alternative.

Effectiveness and Reliability – This alternative does not reduce contamination and has no short-term and long-term effectiveness or reliability in maintaining acceptable risk levels for exposure risks to groundwater exceeding SSCLs. In conjunction with passive or active treatment with chemical reagent, this alternative could provide a significant increase in effectiveness and reliability by reducing the quantity of groundwater that would need to be treated. O&M would be required to maintain the integrity of the remedy and ensure continued performance as designed.

Practicability and Implementability – The capture and diversion of water are considered standard and conventional construction practices. Engineering and construction contractors with the experience and equipment necessary to complete the work are available regionally. This alternative is practicable and implementable at the UBMC.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $464,514. Cost details and calculations for this alternative are included in Appendix A: EA2 – pp 4-5.

10.3.12 Alternative 12 – Inundation (Groundwater in Mine Workings)

Under this alternative, an inundation control (bulkhead/wet mine seal or plug) is installed to raise the water level within the mine workings to reduce acid mine drainage through the reduction of oxygen available to the ore body.

Protectiveness – This alternative would eliminate the potential for direct contact with contamination at the adit and is protective of human health and the environment in the short-term and long-term. The increased hydraulic head behind the plug may cause groundwater to create new seeps or increase groundwater gradients in the area, which may create additional O&M requirements such as retention basins.

Compliance with ERCLs - Under this alternative, potentially impacted groundwater remains within the mine workings. Groundwater that exceeds SSCLs would not be remediated although it would be contained, assuming no seeps occurred as a result of increased hydraulic head behind the plug.

Mitigation of Risk – Inundation of an adit with discharge concentrations exceeding the SSCLs provides complete mitigation of the risks to human health and the environment related to the adit discharge. Continued risk may be present if new uncontrolled seeps develop.

Effectiveness and Reliability – This alternative is considered highly effective and reliable in both the short-term and long-term when installed and maintained properly. The alternative can be very effective if combined with water collection and treatment alternatives. O&M

would be required to maintain the integrity of the remedy and ensure continued performance as designed.

Practicability and Implementability – The sealing of an adit and resultant inundation are considered standard and conventional mining practices. This alternative is practicable and implementable at the UBMC. Adit sealing and inundation has been used at other locations within the UBMC with success.

Treatment or Resource Recovery Technologies - This alternative does not rely on treatment or resource recovery technologies.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $10,124. Cost details and calculations for this alternative are included in Appendix A: EA2 – pp 6-7.

10.3.13 Alternative 13 – Active Chemical Reagent (Groundwater)

This alternative involves adding a neutralizing agent, such as lime (calcium oxide or calcium hydroxide) to impacted water, followed by a settling pond for metals precipitation. The addition of sodium hydroxide or calcium hydroxide directly to water promotes the precipitation of metal hydroxides, thus reducing the amount of metals in the water. This alternative is applicable to the groundwater areas listed in EA 2 (Table 12-2). The process is being used as part of the existing WTP system and when combined with ceramic microfiltration has proven effective. By itself, the alternative will not effectively remediate COCs to SSCLs. Because of the complexity and unknowns associated with the underground workings at the Carbonate, Paymaster, and Upper Mike Horse bedrock aquifer sites, it may not be feasible to capture all of the groundwater at each of these sites. Additional data collection and bench-scale tests would be necessary as part of remedial design.

Implementation of the alternative requires a capture and conveyance system to either a common treatment plant for all sources, or to individual treatment plants. For the purpose of developing costs, DEQ assumed that waters would be conveyed to the WTP for treatment and the WTP would be expanded accordingly to accommodate the increased flows. There is currently a capture and conveyance system in place for the Mike Horse adit discharge and seep water and for the Anaconda adit water. A new capture and conveyance system would be required at the Carbonate, Paymaster, and Upper Mike Horse bedrock aquifer sites. At each of these sites, the system would involve an interception trench and/or series of wells to capture the water, and a pumping station and pipeline to convey flows to the WTP. Design of the capture systems would require the collection of additional data on the aquifer properties (e.g., extent of contamination geology, hydraulic conductivity).

Protectiveness – This alternative by itself is not protective of human health and the environment because contamination would remain in place at concentrations exceeding SSCLs. However, if combined with other alternatives, active chemical reagent could provide protection from elevated metals within groundwater migrating off-site. A combination of the alternatives would minimize exposure risks for metals within downgradient groundwater and surface water for the short-term and long-term for public health, safety or welfare or the environment.

Compliance with ERCLs - Under this alternative, groundwater would be intercepted and treated at a centralized location. Contaminated groundwater exceeding SSCLs would remain

at each location prior to interception and without removal of the contamination source, would not comply with ERCLs within any timeframe based on engineering judgment. Compliance with ERCLs may be achieved at the outflow of the WTP when combined with other active treatment alternatives based on the operation of the existing WTP.

Mitigation of Risk – There would be no mitigation of risk from exposure to contaminated groundwater with this alternative, but if combined with other alternatives, some mitigation of risk may be achieved.

Effectiveness and Reliability – Because this alternative by itself would not remove COCs to standards, it is not effective or reliable in either the short-term or long-term, unless combined with active physical/mechanical treatment. This alternative, combined with ceramic microfiltration, has proven to be effective and reliable at the existing WTP. O&M would be required to maintain the integrity of the remedy and ensure continued performance as designed.

Practicability and Implementability – This alternative has proven practicable and implementable for the Anaconda Adit water and the Mike Horse Adit discharge and seep water. Because of the complexity and unknowns associated with the underground workings at the Carbonate, Paymaster, and Upper Mike Horse bedrock aquifer, it is likely not feasible to capture all of the groundwater at each of the sites. It is also uncertain whether or not the existing WTP location could accommodate the expansion necessary to treat these waters.

Treatment or Resource Recovery Technologies - This alternative does rely on treatment technologies. The treatment may produce sludges or byproducts that require disposal.

Cost Effectiveness – The estimated total present worth cost for implementing this alternative at the UBMC is $17,456,250. In estimating costs for waters not currently treated at the WTP, an estimated construction cost for expansion of the WTP of $3,500,000 was used as a basis for proportioning costs for treating additional water, based on flow rates. Given the current design of the WTP, it is difficult to segregate chemical treatment costs from physical/mechanical treatment costs; therefore, for cost estimation purposes, the overall costs were allocated equally. Cost details and calculations for this alternative are included in Appendix A: EA2 – pp 8-10.

10.3.14 Alternative 14 – Active Physical/Mechanical Treatment (Groundwater)

This alternative involves the use of ceramic microfiltration to filter contaminants out of the water by pumping through a ceramic membrane. This alternative is applicable to the groundwater areas listed in EA 2 (Table 12-2). The process is currently being used as part of the existing WTP system and is effective when combined with pretreatment with a chemical reagent. By itself, the alternative will not effectively remove COCs to SSCLs. Determining the effectiveness for groundwater at the Carbonate and Paymaster sites and the Upper Mike Horse bedrock aquifer will require additional data collection and bench-scale tests to assess as part of remedial design.

Implementation of the alternative requires a capture and conveyance system to either a common treatment plant for all sources, or to individual treatment plants. For the purpose of developing costs, it is assumed that all waters would be conveyed to the WTP for treatment and the WTP would be expanded accordingly to accommodate the increased flows. There is currently a capture and conveyance system in place for the Mike Horse adit discharge and seep water and for the Anaconda adit water; a new capture and conveyance system would be required at the

Carbonate, Paymaster, and Upper Mike Horse bedrock aquifer sites. At each of these locations, the system would involve an interception trench and/or series of wells to capture the water, and a pumping station and pipeline to convey flows to the WTP. Design of the capture systems would require the collection of additional data on the aquifer properties (e.g., extent of contamination, geology, hydraulic conductivity).

Protectiveness – This alternative by itself is not protective of human health and the environment. However, if combined with other alternatives, active physical/mechanical treatment could provide protection in certain areas from elevated metals within groundwater. These actions together would minimize exposure risks for metals within downgradient groundwater and surface water for the short-term and long-term for public health, safety or welfare or the environment.

Compliance with ERCLs - Under this alternative, groundwater would be intercepted and treated at a centralized location. Contaminated groundwater exceeding SSCLs would remain at each location prior to interception and, without removal of the contamination source, would not comply with ERCLs within any timeframe based on engineering judgment. Compliance with ERCLs may be achieved at the outflow of the WTP when combined with other active treatment alternatives based on the operation of the existing WTP.

Mitigation of Risk – There would be no mitigation of risk from exposure to contaminated groundwater with this alternative, but if combined with other alternatives, partial or complete mitigation of risk outside of the source area may be achieved.

Effectiveness and Reliability – Because this alternative by itself would not remove COCs to standards, it is not effective or reliable in either the short-term or long-term, unless combined with active chemical treatment. This alternative, combined with alkaline amendment (active chemical treatment), has proven to be effective and reliable at the existing WTP. O&M would be required to maintain the integrity of the remedy and ensure continued performance as designed.

Practicability and Implementability – This alternative has proven practicable and implementable for the Anaconda Adit water and the Mike Horse Adit discharge and seep water. Because of the complexity and unknowns associated with the underground workings, it is likely not feasible to capture all of the groundwater at each of the locations. It is also uncertain whether or not the existing WTP location could accommodate the expansion necessary to treat these waters.

Treatment or Resource Recovery Technologies - This alternative does rely on treatment technologies. The treatment may produce sludges or byproducts that require disposal.

Cost Effectiveness – The estimated total present worth cost for implementing this alternative at the UBMC is $17,456,250. In estimating costs for waters not currently treated at the WTP, the estimated construction cost for expansion of the WTP of $3,500,000 was used as a basis for proportioning costs for treating additional water, based on flow rates. Given the current design of the WTP, it is difficult to segregate chemical treatment costs from physical treatment costs; therefore, for cost estimation purposes, the overall costs were allocated equally. Cost details and calculations for this alternative are included in Appendix A: EA2 – pp 11-13.

10.3.15 Alternative 15 – Passive Chemical Reagent: Permeable Reactive Barrier (Groundwater)

This alternative consists of installing a PRB and cutoff wall to remove metals from contaminated groundwater. This technology is potentially applicable to sites requiring treatment of near-surface groundwater. Treatment of the Upper Mike Horse bedrock aquifer groundwater with this technology is not practicable because of the depth to water and the difficulties in intercepting water in a complex bedrock environment. Therefore, it is potentially applicable to the Anaconda adit discharge, the Carbonate Mine, the Mike Horse adit discharge and seeps, and the Paymaster alluvial aquifer in EA 2 (Table 12-2). Because this alternative requires interception of all contaminated water, the use of this alternative at each of these locations will require additional investigation and data to characterize the extent of contamination, water quality chemistry, and the aquifer properties at each location to maximize effectiveness. The CSM for the Carbonate Mine groundwater suggests that PRB may be a viable alternative at that location if near-surface groundwater requires treatment. Future monitoring would need to be performed to determine whether near-surface contaminated groundwater may be emanating from the Carbonate Mine and potentially affecting the Blackfoot River.

Protectiveness – This alternative could provide protection from elevated metals within groundwater migrating beyond the source area and could therefore minimize exposure risks for metals within downgradient groundwater and surface water for the short-term and long-term for human health and the environment.

Compliance with ERCLs – Under this alternative, near-surface contaminated groundwater, if leaving the Carbonate Mine site, may comply with DEQ-7 standards and compliance with ERCLs could be expected to be achieved within 5 to 10 years. The compliance timeframe is based on performance at sites such as the Success Mine and Mill site in Idaho, where a PRB utilizing phosphate-induced metal stabilization successfully reduced concentrations of lead, cadmium, nitrate, and sulfate to below detection levels and lead to near background levels within 2 years (Conca 2003). Compliance with ERCLs through implementation of this alternative for the other locations will require additional data to maximize effectiveness of the remedy. It is unlikely that this alternative would meet ERCLs in these areas unless combined with source removal.

Mitigation of Risk – The Carbonate Mine site CSM estimates that the Carbonate Mine site has the potential to contribute enough cadmium to the Blackfoot River during base flow to increase in-stream concentrations to more than twice the applicable DEQ-7 standard. There would be significant mitigation of exposures to risk under this alternative for near-surface contaminated groundwater if leaving the Carbonate Mine site because any concentrations of cadmium and other metals in the groundwater leaving the Carbonate Mine site would be significantly reduced. Potential mitigation of risk within the Anaconda adit discharge, the Carbonate Mine, the Mike Horse adit discharge and seeps, and the Paymaster alluvial aquifer is unknown, due to lack of data to characterize the extent of contamination, water quality chemistry, and the aquifer properties at each location to maximize effectiveness.

Effectiveness and Reliability – This alternative could have significant short-term and long-term effectiveness or reliability in maintaining acceptable risk levels for exposure risks to downstream groundwater and surface water at the Carbonate Mine site, should monitoring demonstrate a potential for near-surface contaminated groundwater to affect the Blackfoot

River. Effectiveness and reliability for the Anaconda adit discharge, the Carbonate Mine, the Mike Horse adit discharge and seeps, and the Paymaster alluvial aquifer is unknown, due to lack of data to characterize the extent of contamination, water quality chemistry, and the aquifer properties at each location to maximize effectiveness. Because of the complexity and unknowns associated with the underground workings, it is likely not feasible to capture all of the groundwater at each of the sites. Periodic replacement of the PRB substrate will be required to ensure long-term effectiveness.

Practicability and Implementability – PRB is an understood water treatment technology; however, all of the installation equipment may not be locally available. This alternative would require additional site investigations and pilot studies to ensure optimization of the designs.

Treatment or Resource Recovery Technologies - This alternative does rely on the use of PRB, a treatment technology.

Cost Effectiveness – If this alternative were to be applied site-wide at all applicable areas, the estimated total present worth cost for implementation at the UBMC would be $7,827,027. Cost details and calculations for this alternative are included in Appendix A: EA2 – pp 14-16.

10.4 Comparative Analysis of Alternatives

The alternatives were evaluated and compared against the seven cleanup criteria identified in

§ 75-10-721, MCA. Protectiveness and compliance with ERCLs are threshold criteria that must be met for any remedy. In the comparative analysis, the remaining criteria are weighed and evaluated to identify the best overall alternatives for each media, and include considerations of present and reasonably anticipated future uses of the UBMC and the use of ICs. Each criterion is listed individually below. A list of the alternatives and their corresponding numbers is also provided to aid in this analysis.

Solid Media and Liquid Media Alternative

- Alternative 1 – No Action

Solid Media and Physical Hazard Alternatives

- Alternative 2 – Monitored Natural Recovery (MNR)
- Alternative 3 – Physical Barriers
- Alternative 4 – Containment
- Alternative 5 – Removal and On-site Disposal
- Alternative 6 – Removal and Off-site Disposal
- Alternative 7 – In Situ Neutralization with Alkaline Amendment
- Alternative 8 – Ex Situ Neutralization with Alkaline Amendment

Groundwater and Surface Water Alternatives

- Alternative 9 – Monitored Natural Attenuation (MNA)
- Alternative 10 – Containment (Retention Pond)

- Alternative 11 – Hydrologic and Hydraulic Control
- Alternative 12 – Inundation
- Alternative 13 – Active Chemical Reagent
- Alternative 14 – Active Physical/Mechanical Treatment
- Alternative 15 – Passive Chemical Reagent: PRB

None of these alternatives will clean up the entire UBMC by itself so it is likely that the best remedy may consist of a combination of different alternatives. Due to the size of the UBMC, the extent of contamination, and the affected media, some of the remedial alternatives listed above are specific to affected material and areas. Alternatives 2 through 8 address soil, sediment, and physical hazards. Alternatives 9 through 15 address groundwater, including adit discharge. Alternatives 10 through 14 address surface water. Alternatives 2 through 8 will be compared to each other. Alternatives 9 through 15 will be compared to each other for groundwater, while Alternatives 10 through 14 will be compared to each other for surface water. All the alternatives will be compared to Alternative 1 (No Action).

10.4.1 Protectiveness

Alternative 1 provides no protection to human health and the environment. Alternative 2 provides no protection from unacceptable risks in the short-term for public health, safety or welfare or the environment, but may become protective in the long-term. Alternative 3 does provide protection from unacceptable risks in the short-term and long-term for public health, safety or welfare or the environment by addressing the physical safety hazards associated with mine adits. Alternatives 4, 7, and 8 provide some protectiveness by covering or reducing the mobility of COCs in solid media. However, because the contaminated media remains in place, there will continue to be a risk of exposure. If Alternative 4 were combined with Alternative 7 or 8, the protectiveness would be increased. Alternatives 5 and 6 provide the greatest level of protectiveness for the solid media options because all waste material exceeding SSCLs would be removed. Alternative 9 provides no protection from unacceptable risks in the short-term for public health, safety or welfare or the environment, but may become protective in the long-term. Alternative 10 is protective downstream of the remedy, but not within the retention area. Alternative 11 provides no protection from risks in either the short-term or long-term for public health, safety, and welfare or the environment. Alternative 12 is protective, provided the adit plug remains intact and no new seeps form as a result of the adit plug. Alternatives 13 and 14, by themselves are not fully protective, but, if combined, could provide protectiveness by treating water to meet standards before it leaves the source area. Alternative 15 could provide protectiveness downgradient by preventing contaminated groundwater from migrating beyond the source area.

10.4.2 Compliance with ERCLs

Alternative 1 does not comply with ERCLs. Alternative 2 would not meet surface water ERCLs in the short-term, but may in the long-term. Alternative 3 only address safety hazards so it does not comply with ERCLs by itself. Under Alternatives 4, 7, and 8, contaminated soils remain in place and could continue to leach COCs to groundwater so compliance with ERCLs would not be achieved. Alternatives 5 and 6 would achieve ERCLs compliance within a short period in some areas through removal of contaminated soils that leach to

groundwater or impact surface water, and placement in a repository that complies with ERCLs, although removal may result in an adverse impact to wetlands in EA4. However, other areas wouldn't achieve ERCLs in the short term because groundwater wouldn't be immediately addressed. Alternative 9 would not meet groundwater ERCLs in the short-term, but with source removal, ERCLs compliance would be achieved in the long-term. Alternative 11 would not improve the quality of surface water or groundwater and would not comply with ERCLs. Alternative 10 would not achieve compliance with ERCLs, but may achieve compliance with ERCLs when combined with other alternatives. Alternative 12 does not meet groundwater ERCLs although it does meet surface water ERCLs by controlling groundwater within the adit. Alternatives 13 and 14, if combined, would meet DEQ-7 standards at the point of discharge. Alternative 15 could comply with groundwater ERCLs downgradient of the system at the Carbonate site and improve the compliance of surface water in the downgradient Blackfoot River for any exceedances of SSCLs.

10.4.3 Mitigation of Risk

Alternative 1 does not mitigate risk. Mitigation of risk may be achieved through Alternative 2 over a long period as natural recovery processes occur within stream sediments, although the success of this remedy is dependent on source removal and control. Alternative 3 provides mitigation of safety risks through the use of physical barriers. Alternative 4 provides mitigation of the risk presented by direct contact, but may not completely mitigate the risks to surface water or groundwater because contamination is left in place. Alternatives 5 and 6 provide the greatest level of risk mitigation for the solid media alternatives through removal of the waste sources to meet SSCLs. Alternatives 7 and 8 provide some mitigation of risk through the reduction of metals mobility in the soils. Alternative 9 does not mitigate risk in the short-term, but there would be some mitigation of risk in the long-term as COC concentrations decrease over time after source removal. There is no mitigation of exposures to risk under Alternatives 10 and 11, although Alternative 10 provides mitigation downstream (below the retention pond) of the seep or spring, but not for the water contained in the retention pond. Alternative 12 provides mitigation of risk through maintaining an effective seal on the adit thereby limiting direct contact with contaminated water near the adit. Alternatives 13, 14, and 15 mitigate risk by treating contaminated groundwater to meet SSCLs.

10.4.4 Effectiveness and Reliability

Alternative 1 provides no short-term or long-term effectiveness or reliability. Alternatives 2 and 9 are not effective or reliable in the short-term, but are effective and reliable in the long-term when combined with source removal and control. Alternative 3 has proven to be effective and reliable for addressing physical hazards at the UBMC and other mining sites. Alternative 4 is effective and reliable in the short-term by limiting contact with contamination, but is less effective and reliable in the long-term due to weathering and erosion. Alternatives 5 and 6 provide the most effectiveness and reliability because waste materials are removed and placed in an engineered repository. Alternatives 7 and 8 may be effective and reliable in limiting contact with contamination and reducing leaching to groundwater. Alternative 9 is effective and reliable in the long-term provided there is adequate source removal and control. There is significant short-term and long-term effectiveness and reliability in maintaining acceptable risk levels under Alternatives 10 and

12; however, Alternative 12 has limited use. Alternatives 13 and 14, if combined, have proven to be effective and reliable at reducing COC levels to SSCLs at the existing WTP. By itself, Alternative 11 has no short-term or long-term effectiveness or reliability in maintaining acceptable risk levels; however, when combined with other alternatives, it can be effective at reducing the quantity of groundwater that would need to be treated. Alternative 15 may be effective in the long-term, but has limited use.

10.4.5 Practicability and Implementability

Alternative 1 is easily implementable. Alternatives 2 and 9 are technically practicable and implementable utilizing and expanding the existing monitoring network. Alternatives 3, 4, 5, and 6 are each technically practicable and implementable. Alternatives 7 and 8 are technically practicable at some sites within EA 1 and EA 5 provided that a suitable source of lime is available. Alternatives 10, 11, and 12 only address groundwater and surface water, and are practicable and implementable at sites within EA 2 (groundwater) and EA 3 (surface water). Alternatives 13 and 14 have proven to be technically practicable and implementable at the existing WTP for treating water from the Anaconda Mine adit and Mike Horse Mine adit and seeps. Implementation of Alternative 15 is practicable and implementable at the Carbonate Mine site should monitoring demonstrate a potential for near-surface contaminated groundwater to affect the Blackfoot River.

10.4.6 Treatment or Resource Recovery Technologies

Alternatives 1, 2, 3, 4, 5, 6, 9, 10, 11, and 12 do not rely on treatment or resource recovery technologies. Alternatives 7 and 8 rely on soil amendment with lime treatment. Alternative 13 relies on a suite of neutralizing chemical reagents for treatment. Alternative 14 relies on proven filtration treatment technology. Alternative 15 relies on PRB technology.

10.4.7 Cost Effectiveness

All costs are estimated and actual costs may vary. Estimates are refined once DEQ issues the ROD and remedial design is completed. The estimated total present worth cost for implementing each alternative are in Tables A-1 and A-2 in Appendix A. Alternative 1 is the least expensive alternative, but provides no risk reduction for soil, sediment, groundwater, or surface water at the UBMC. Alternative 3 provides no risk reduction for soil, sediment, groundwater, or surface water, but does reduce risk where physical hazards are a concern.

Soil/sediment alternatives 2, 4, 7, and 8 provide some risk reduction, but do not address all contamination because at least a portion of the contamination is left in place for each of the alternatives. Soil/sediment alternatives 5 and 6 provide the same risk reduction, but Alternative 6 is more expensive than Alternative 5 with no additional risk reduction. Alternative 9 provides long-term risk reduction, but is only effective when combined with a removal and source control alternative.

Groundwater/surface water alternatives 10, 11, and 12 provide some risk reduction and are less expensive than other groundwater treatment alternatives, but do not address all contamination. Alternatives 13 and 14 provide risk reduction and have similar costs. Alternative 15 is less expensive than Alternatives 13 and 14, but is only applicable to specific areas within the UBMC.

11.0 SCOPE OF THE PREFERRED REMEDY

As described earlier, for those federal lands within the UBMC that were not included in the Action Memorandum, as amended, the USFS will issue a separate decision. This Proposed Plan identifies DEQ's preferred remedy for the non-federal land within the UBMC. Work will be performed in coordination with NRDP restoration efforts.

For those non-federal lands within the UBMC, DEQ selected a combination of alternatives to address physical hazards and cleanup soil, sediment, groundwater, and surface water. These include physical barriers for adit openings or related physical hazards in EA5; removal and on-site disposal of impacted soil and sediment in EAs 1, 3, 4 and 5; containment of impacted soil in EA1; MNR for sediments in EAs 3,4, and portions of EA5; MNA for the groundwater in EA4; containment of adit discharges, seeps, and springs in EA3;hydrologic and hydraulic control for upgradient groundwater and surface water combined with passive chemical reagent PRB for some groundwater in EA2; inundation for adit seepage control in EA2; and active chemical reagent combined with active physical/mechanical treatment to address adit discharge in EA2. Site-wide elements will be implemented as well and will include ICs, engineering controls/access restrictions (fencing and/or warning signs), and long-term monitoring and maintenance. There are no remedial actions proposed to solely address UBMC surface water. Achieving the SSCLs for surface water quality will come from successful implementation of the preferred remedies for soil, sediment, and groundwater that surround the UBMC surface water bodies. Monitoring will evaluate the effectiveness of the remedies for the other media and confirm that SSCLs are met in surface water.

Some interim actions have been conducted, as discussed previously**,** which helped reduce the threat to public health, safety, and welfare and the environment. This has been demonstrated in the decreasing trend of metals concentrations in the surface water. While not all of the interim actions have been completely effective, they have contributed to the preferred remedy selection because they reduced metals concentrations in soils and sediments and/or the potential for acid mine drainage from soils, or treated metals in adit discharge in some areas.

Interim actions that have been effective and proposed for inclusion as part of the final remedy include the Carbonate and Paymaster repositories, the adit plugs, and the WTP. The Carbonate repository design considered stability, drainage, potential settlement, mine shaft remediation, infiltration/water balance (HELP modeling), acid/leachate production, erosion control, floodplain protection, and revegetation. Construction was completed in 1994. The Paymaster repository design considered stability, drainage, potential settlement, mine shaft remediation, infiltration/water balance (HELP modeling), acid/leachate production, erosion control, floodplain protection, and revegetation. Construction was completed in 1997. Also in 1997, a grout seal was placed in the Capital Mine adit effectively inundating the Capital Mine workings with the groundwater discharge, while eliminating the seasonal discharge of water from the adit. That seal will be inspected and maintained as part of long-term monitoring and maintenance at the UBMC. Constructed in 2008, the WTP combines ceramic microfiltration technology with active chemical reagent treatment to effectively treat adit water from the Mike Horse and Anaconda mines. It also captures seeps from the upper and lower Mike Horse mine areas and Anaconda mine area.

As part of evaluating the success of interim actions, DEQ found that ASARCO and ARCO constructed the Mike Horse Repository within the 100-year floodplain, which does not comply with ERCLs. The sampling conducted during the RI indicated that repository seeps are impacting groundwater and surface water. In addition, the sludge-drying beds located on top of the repository do not meet cap requirements for a solid waste repository. Therefore, this repository is being removed as an interim action, which is consistent with the proposed final remedy for the UBMC.

The interim action to remove the Mike Horse Repository began in 2014 and is designed to run concurrently with the removal of the Beartrap tailings impoundment located on federal land, which is covered by the Action Memorandum, as amended. This interim action includes removal of the Mike Horse Repository, along with the floodplain waste running the length of the mine site. It also includes an upgrade to the seep capture systems at the Mike Horse mine.

Consistent with the decision made by the USFS in its Action Memorandum, as amended, remedial actions started in 2013 by initiating construction on the UBMC (Section 35) Repository and in 2014 by beginning removal of the Mike Horse dam and tailings impoundment. The Lower Mike Horse Creek, Beartrap Creek, and Blackfoot River portions of the Action Memorandum, as amended, will follow.

11.1 **The Preferred Remedy**

The following describes DEQ's preferred remedy for the non-federal land within the UBMC. Engineering and design details for the preferred remedy will be specified in the remedial design documents to be issued after the ROD.

The total cost for the preferred remedy, including the site-wide elements, is $14,559,601. This cost does not include federal land cleanup costs. The cost estimate is based on the assumption that the alternatives will meet the estimated cleanup timeframes and these are preliminary estimates only. Actual costs and cleanup timeframes may vary and cost estimates will be further refined during remedial design. Costs and assumptions used in calculating the total present value of this preferred remedy are provided along with other cost tables in Appendix A and are summarized in Table 13. The preferred remedy was evaluated as provided for in Section 75-10-721, MCA; however, the preferred remedy may be revised in response to public comment or new information. DEQ's final remedy decision for the non-federal land at the UBMC will be documented in the ROD.

11.1.1 EA1 Upland Waste Areas

Impacted soils in EA1 at the UBMC will be addressed in one of three ways, and will also include the use of site-wide elements.

Soil exceeding SSCLs in EU4, EU6, and in that portion of EU7 not on federal land will be removed and placed in the on-site UBMC Repository (Alternative 5). Removal of impacted soils will significantly reduce metals concentrations in the Upland Waste Areas (EA1). When possible, contaminated wastes and soils will be excavated to meet SSCLs. There are areas, such as EU8, where removal to this level is not possible because of the physical constraints (exposed ore body, steep slopes, proximity of mine workings, etc.) of the area. In that case, removal to a physical/visual indicator like groundwater, underlying native lithologic unit, pre-determined

over-excavation depth, or bedrock may be used and will be determined during remedial design. Removal will be applied to any soil-like material at the UBMC including, but not limited to, waste rock, tailings, metals laden overburden, spoils, or contaminated underlying soils. Upland Waste Areas EU4 (iron, lead, and manganese), EU6 (arsenic and lead), and EU7 (arsenic and lead)will require removal to SSCLs, while at EU8 (arsenic, cadmium, copper, lead, manganese, and zinc) the accessibility concerns, including proximity to mine workings and steep slopes, may only allow for removal in certain discrete areas.

For EU8, where complete removal to SSCLs may not be possible, containment (Alternative 4) will also be used to address the EU8 soils that cannot be removed. Establishing a vegetative cover under these circumstances may not be feasible and has already been unsuccessful in two prior interim actions. Therefore, containment under these circumstances will include use of angular rock cover to reduce direct contact, and the erosion and transport of contaminated media associated with rainfall. Containment does not fully isolate or eliminate contaminants leaching to groundwater, but contaminated groundwater in EU8 will be mitigated by the Upper Mike Horse seep capture system that is already in place as part of the existing WTP. Details of the containment will be further defined as part of remedial design.

For EU1A, EU1B, and EU3, engineering controls such as fencing and warning signs are proposed. These EUs are difficult to access due to steep slopes that are sometimes heavily timbered with either unmaintained roads or no roads at all. These conditions make removal or containment very difficult. These very same conditions also make human foot travel difficult, which greatly limits recreationalists in these areas. Therefore, fencing and/or warning signs will limit human exposure to these areas. ICs (site-wide elements) are also proposed since some form of land use control is required to prevent exposure to arsenic and lead concentrations that exceed SSCLs.

For EU5 and EU9A, No Action is the proposed remedy. In EU5 there were slight exceedances of arsenic and lead. However, when assessed using ProUCL (Appendix C), the average (95 percentile) arsenic (18.5 mg/kg) and lead (249 mg/kg) concentrations in EU5 are well below the surface soil SSCLs. In EU9A, there are slight exceedances of the copper SSCL; however, the physical condition of the waste area habitat is poor and it is unlikely to be used by wildlife. Small (< 0.15 acres at EU9A), sparsely vegetated or bare waste piles are not appealing habitat when the vast majority of surrounding area is undisturbed, suitable habitat (TetraTech 2013b). Therefore, it is anticipated that the ecological receptors preference for the undisturbed habitat will provide adequate protection for ecological receptors. As described in Section 8.5, copper does not pose an unacceptable risk to human health.

For EU9B, maintaining the current subsurface geochemical/oxidation state conditions in the vicinity of the Paymaster constructed wetland system is likely essential to limiting widespread deposition of ferrous iron and increased metal mobility of at least arsenic and possibly other metals. Therefore, ICs (site-wide elements) to prohibit excavation and construction in these areas will be protective of human health.

11.1.2 EA2 Groundwater

There are five distinct groundwater areas in EA2: Anaconda adit discharge, Mike Horse adit discharge and seeps, Carbonate Mine groundwater, Upper Mike Horse Mine bedrock groundwater aquifer, and Paymaster Gulch groundwater aquifers. The impacted groundwater in EA2 will be addressed through active chemical reagent treatment combined with active

physical/mechanical treatment, or inundation as an engineering control, or hydrologic and hydraulic control combined with a passive chemical reagent PRB or through the use of site-wide elements.

Anaconda and Mike Horse Adit Discharges and Seeps

The Anaconda Mine adit discharge and the Mike Horse Mine adit discharge and seeps are currently being treated at the WTP, and continuing that treatment is proposed as the preferred remedy (Alternatives 13 and 14). The Upper Mike Horse Mine bedrock groundwater aquifer is also currently addressed through the WTP interim action, and that would continue as part of the preferred remedy. Seep capture systems were included in the construction to treat seeps at the upper Mike Horse waste piles area, the base of the Mike Horse Repository, and next to Cell 4 from the old wetland system. If the seep associated with the Mike Horse Repository is still present and contaminated after the interim action removes the repository, then water from it will continue to be captured and treated. The WTP incorporates ceramic microfiltration technology with active chemical reagent to treat the discharges from the two mines, which includes the Upper Mike Horse Mine bedrock groundwater that infiltrates into the Mike Horse mine workings. After treatment in the WTP, water meets SSCLs.

Carbonate Mine Groundwater

For the Carbonate Mine groundwater, the proposed remedy is hydrologic and hydraulic controls combined with a PRB (Alternatives 11 and 15) to treat the contaminated groundwater should monitoring demonstrate a potential for near-surface contaminated groundwater to affect the Blackfoot River. Because this remedy requires interception of all contaminated water, additional investigation is required as part of remedial design to better define the extent of contamination, water quality chemistry, and the aquifer properties to maximize effectiveness. In order to limit exposure to groundwater in the Carbonate area, the preferred remedy will also require ICs (site-wide elements) in the form of restrictive covenants, a controlled groundwater area, or both.

Upper Mike Horse Mine Bedrock Groundwater Aquifer

The Upper Mike Horse Mine Bedrock Groundwater Aquifer is addressed through the WTP interim action, which is being retained as the proposed remedy (Alternatives 13 and 14). The ongoing interim action at the Mike Horse Mine Area will address the alluvial aquifer through the removal of waste sources and reconstruction of the Mike Horse Creek channel and floodplain. However, the bedrock aquifer will likely continue to flood the mine workings in this area. In order to limit exposure to groundwater in the bedrock aquifer, the preferred remedy will also require ICs (site-wide elements) in the form of restrictive covenants, a controlled groundwater area, or both.

Paymaster Gulch Groundwater Aquifers

As described in Section 5.7.1, based on the metal concentrations found in the shallow and bedrock wells, the water quality in the Paymaster Mine area wells is similar to the water quality in the background wells. This similarity in water quality suggests that the Paymaster Mine area groundwater is reflective of the highly mineralized background conditions. The location-specific background number for the Paymaster area is the SSCL for that area, and no groundwater remedy is required.

11.1.3 EA3 Surface Water and Sediment

Blackfoot River (EU12 and EU13)

The preferred remedy for the streambed sediments in the active Blackfoot River channel from the start of the western Upper Marsh to Hogum Creek is MNR (Alternative 2). The remedy for the active Blackfoot River channel within the eastern Upper Marsh is addressed in Section 11.1.4. Stream sediments were sampled below the Upper Marsh to Highway 279 during the RI in 2007 and 2008 and from Highway 279 to Hogum Creek during the RI in 2011. Although stream sediment samples were not collected from below the Upper Marsh to Hogum Creek during the same time period, the data indicate that COC concentrations generally decreased downstream from below the Upper Marsh to Hogum Creek, and at the confluence of the Blackfoot River with Alice Creek at BRSW-205 no SSCL exceedances were noted. Sampling location BRSW-104 will be included in the MNR monitoring plan to assure that the spring/summer sample was anomalous and that MNR is occurring in that area. MNR does not disturb large areas of active river channel through sensitive ecosystems. When combined with the source removals at and above the Upper Marsh, MNR is a protective remedy through a reach of the Blackfoot River that is already showing decreased metals concentrations from upstream to downstream.

Stevens Creek (Gulch)

Waste source removals, including sediments, are addressed in EA5.

Paymaster Creek

The preferred remedy for the Paymaster Creek streambed sediments is removal and disposal at the on-site UBMC Repository (Alternative 5). The BRSW-13 sediment sample, located immediately downstream of the Paymaster Mine area, is the only one of the four samples collected that shows exceedances of COCs. Arsenic exceeds the sediment SSCL at 0 to 2 inches, 2 to 6 inches, and 6 to 12 inches; lead exceeds the SSCL at 2 to 6 inches and 6 to 12 inches; and copper exceeds the SSCL at 6 to 12 inches. Paymaster Creek was rerouted and reconstructed around the passive wetland treatment system. The extent of sediment contamination in this area is a data gap that will be addressed during design. The FS uses a remediation volume estimate of 30 cubic yards of sediment, based on engineering judgment assuming a 1-foot removal depth across 4 feet of stream channel for 200 feet of creek.

Shave Creek (Gulch)

Waste source removals, including sediments, are addressed in EA5.

Unnamed Tributary above WTP

The preferred remedy for the unnamed tributary streambed sediments is MNR (Alternative 2), combined with source removal at mining-related feature BR-39 as addressed in EA5. This unnamed tributary located west of the Upper Anaconda Mine Waste Piles (EU 1B) has a drainage area of approximately 75 acres and drains south to the WTP. Flow in the tributary was sampled during the RI immediately downgradient from mining-related feature BR-39 a collapsed adit and waste rock pile situated approximately 700 feet uphill from the WTP. The sampled water at BTSW-101 exceeded DEQ-7 aquatic life standards for chronic cadmium (0.00099 mg/L, standard is 0.00025 mg/L) and zinc, and acute zinc (0.16 mg/L, standard for chronic and acute zinc is 0.112 mg/L). The flow rate was measured in the RI at less than 0.039 cfs. No

sediment samples were collected. The unnamed tributary is located in a steep, highly mineralized area and its flows are generally low and intermittent. MNR is proposed under these conditions and monitoring will confirm that SSCLs are eventually met.

Mining-related Feature Discharge, Seep, or Spring

The mining-related feature discharges, seeps and springs will use the following criteria to determine a preferred remedy. The preferred remedy for features located in areas with easy to moderate access is containment (Alternative 10). The preferred remedy for features located in areas with difficult access will be access restrictions (site-wide elements). These areas are characterized by very steep and often heavily timbered slopes with very few established roads for access. Stevens Gulch (site for two of the three features) is also located in a highly mineralized copper-molybdenum ore body (Figure 14). Road construction in this area would be extremely difficult and would be compounded by the likelihood of exposing the ore body or highly mineralized soil, which could potentially cause more environmental damage by releasing heavy metals. These access conditions make containment very difficult. These very same conditions also make human foot travel extremely difficult, which greatly limits recreational use in these areas. Therefore, fencing and/or warning signs, used as access restrictions, are effective remedies for these remote features.

The preferred remedy for mining-related feature BR-14 (difficult access) is fencing and signage to restrict access (site-wide elements) if SSCLs are exceeded in samples collected during remedial design. BR-14 is a collapsed adit with leaking water that was pooled near the adit entrance and supporting vegetation. No flow or water quality data were collected and these data gaps will be addressed during design.

The preferred remedy for mining-related feature SG-71 (difficult access) is fencing and signage to restrict access (site-wide elements) if SSCLs are exceeded in samples collected during remedial design. SG-71 is a spring at a possible adit location approximately 70 feet from Stevens Creek. Water had pooled from the spring to a depth of 6 inches. No flow or water quality data were collected. Lack of flow and water quality data are data gaps that will be addressed during design.

The preferred remedy for mining-related feature SG-94 (difficult access) is fencing and signage to restrict access (site-wide elements). SG-94 is an iron precipitate, cone-forming spring. During the RI, the flow rate was estimated at 2 to 5 gpm and sediment deposition was observed. Surface water sampled in 2008 during the RI at SGSW-104 exceeded the DEQ-7 human health standards for arsenic and iron, and the aquatic standards (chronic and/or acute) for iron and zinc.

The preferred remedy for the historical Paymaster Adit discharge (easy access) is containment (Alternative 10) if SSCLs are exceeded in samples collected during remedial design. The adit was plugged and a discharge collection system and wetland treatment system were installed in 1996-1997 with the intent to discharge water into the upper wetlands cell. Water is currently seeping out of the slope toe and into the road next to the plugged adit. ASARCO abandoned the wetland system by plugging the pipe that flowed between the upper and lower cells. The upper cell could be used as a retention pond if the water quality proves to be poor. Lack of flow and water quality data are data gaps that will be addressed during design. Monitoring and maintenance of the adit plug will occur to assure long-term protectiveness. Wetland cells solid media is addressed as Paymaster Mine Waste Areas in EA 1.

11.1.4 EA4 Upper Marsh

The Upper Marsh has been divided into two areas: the eastern (upstream) portion at 28.0 acres and the western (downstream) portion at 34.3 acres. This division, also used in the BERA, is based on the location of an old drill road constructed within the area prior to the 1975 breach of the Mike Horse tailings impoundment (Figure 19). The marsh is also divided into an eastern area and a western area for the purpose of remedy selection. The active Blackfoot River streambed sediments in the Upper Marsh are addressed in EA3. The proposed remedy only applies to that portion of the marsh on non-federal land as the USFS is responsible for selecting the remedy on federal land.

Upper Marsh (EU12) Eastern Area

The Eastern Marsh preferred remedy will include removal of tailings throughout the eastern marsh floodplain area with on-site disposal (Alternative 5, Figure 20). Removals will be based on achieving marsh sediment SSCLs and will be supported by other lines of evidence, including bioavailability parameters, ABA, and SPLP within the marsh area. Removal in the Eastern Marsh area will extend upstream until it ties in with the downstream extent of the Blackfoot River designated removal area per the EE/CA (Figure 3 and 23). The lateral extent of contamination will be confirmed during remedial design to further identify the extent of areas containing tailings. In addition, the locations of the sensitive areas, such as fens and forested emergent wetlands in Figure 19, will be field verified prior to performing cleanup. The preferred remedy for these sensitive areas does not include removal of contaminated sediments. These sensitive environments take hundreds of years to form and play a crucial working role in the health of the Upper Marsh. Both sensitive area types accumulate peat layers that act as sinks for the metals that come out of the Paymaster and Swamp Gulch drainages. Due to the length of time that it took to establish these areas, removal in these areas may result in more of an adverse impact than leaving contaminated sediment in place within the fen/forested emergent wetland areas. The current plant community health suggests that these areas continue to thrive. Other conditions like submersion (reduces metals mobility) and high organic content (binds metals making them less bioavailable) in the fens and forested emergent wetlands also help reduce exposure risk to ecological receptors.

The preferred remedy for the stream sediments in the active Blackfoot River channel within the eastern Upper Marsh includes removal of tailings and sediment with on-site disposal (Alternative 5). The present channel alignment will be preserved as much as possible during remediation. However, that may or may not be possible if removal of contaminated sediment creates an unstable configuration once the floodplain contaminated sediments are removed to meet SSCLs.

The preferred remedy for the Eastern Marsh will also contain the necessary site-wide elements (ICs and access restrictions) to limit access and protect humans from contaminants that exceed SSCLs in the sensitive areas (fens, forested emergent wetlands). Signs will be posted alerting recreators to the potential health hazards in the area. In addition, the Upper Marsh naturally limits human access because it is extremely difficult to negotiate on foot due to the uneven terrain and heavy vegetation, both submerged by surface water.

Upper Marsh (EU12) Western Area

The Western Marsh preferred remedy will include MNR (Alternative 2, Figure 20). The conditions for this area are conducive to MNR per EPA guidance on sediment remediation (EPA

2005). Total removal of contamination from the Mike Horse Mine/Beartrap Impoundment area down to the upper end of the Upper Marsh, combined with additional removals in the eastern portion of the Upper Marsh, will eliminate a significant sediment contamination loading source to both the Eastern and Western Upper Marsh.

The Western Marsh remedy will also contain the necessary site-wide elements (ICs and access restrictions) to limit access and protect humans from contaminants that exceed SSCLS in the sensitive areas (fens, forested emergent wetlands). Signs will be posted alerting recreators to the potential health hazards in the area. In addition, the Upper Marsh naturally limits human access because it is extremely difficult to negotiate on foot due to the uneven terrain and heavy vegetation, both submerged by surface water.

Allowing contaminated sediments to naturally recover will also be ecologically protective in the long-term. The current plant community health suggests that these areas continue to thrive. Other conditions like submersion (reduces metals mobility) and high organic content (binds metals making them less bioavailable) help reduce exposure risk to ecological receptors in the short-term. However, the sensitive areas (fens, forested emergent wetlands) are likely to continue to act as sinks for metals. Due to the length of time that it took to establish these areas, removal in these areas may result in more of an adverse impact than leaving contaminated sediment in place within the fen/forested emergent wetland areas.

11.1.5 EA5 Mining-related Features

Impacted soils and sediments in EA5 at the UBMC will be addressed either by removal and on-site disposal or addressed through a combination of site-wide elements. In addition, one physical safety hazard is identified in EA5 that will require some form of physical barrier to eliminate the hazard.

Physical Safety Hazards

The Proposed Plan addresses mining-related features on non-federal land that were identified during the RI. The Mining-Related Features (EA5) include a total of 24 locations (Appendix B). One of the features (PC-01) is only a physical safety hazard and does not impact soils, sediments or surface water. A physical barrier (Alternative 3) will reduce or prohibit entry by humans at the open adit at mining-related feature PC-01. Installation of a bat gate, plugging with foam or a bulkhead, or backfilling would sufficiently address the hazardous open adit. The plug option involves installing a polyurethane foam or concrete mass in the entrance and covering the site with clean backfill or rock. Bulkhead development includes a concrete plug with piping and valves for hydraulic controls installed within an adit. The bat gate option involves installing a sturdy, steel grate system over the adit entrance. The bat gate is designed with openings sized large enough to allow bat access and egress, but small enough to prevent entrance by humans and large animals.

These barriers can typically be installed using standard construction planning, manufacturing, equipment, and practices. Installation costs are usually driven by accessibility issues and the physical size of the opening to be closed. The choice of which physical barrier to use will be made during remedial design and will consider size of the hazardous opening, accessibility issues, and ecological protectiveness – use of a closed barrier to prevent all access versus use of an open barrier to allow access for bats and other small animals.

Mining-related Features – Easy or Moderate Access

Of the remaining 23 features (Appendix B), five (BR-14, BR-39, PM-04, SH-13, SH-29) may require removals in areas that are either easily accessible (close to an existing road) or moderately accessible (close to an old road grade on mild slopes with minimal timber). There are no soils and/or sediment metals data available for four of the five locations. The waste pile at BR-39 will require removal and on-site disposal. The soils and/or sediment metals characterization for the other four features is a data gap that will be addressed during design. If SSCLs are exceeded in samples collected during remedial design, removal to meet SSCLs and on-site disposal is the preferred remedy.

Mining-related Features – Difficult Access

The other 18 features (Appendix B) are in difficult areas to access and 6 (SG-47, SG-48, SG-49/50, SG-51, SG-71, SG-93) of the 18 sites are near surface water. All 18 features are characterized by very steep and often heavily timbered slopes with very few established roads for access. Soils and/or sediment metals data is only available for two (SG-93, SG-94) of the 18 locations, and those two features will require fencing and/or warning signs as access restrictions. Soils and/or sediment metals characterization for the other 16 features is a data gap that will be addressed during design to determine if similar access restrictions are necessary. If SSCLs are exceeded in samples collected during remedial design, then warning signs will be used to limit use.

Stevens Gulch (the location of 12 of the 18 features) is also located in a highly mineralized copper-molybdenum ore body (Figure 14). Road construction in this area would be extremely difficult and would be compounded by the likelihood of exposing the ore body or highly mineralized soil, which may cause additional environmental damage by releasing heavy metals. These access conditions make removal or containment very difficult. These very same conditions also make human foot travel extremely difficult, which greatly limits recreational use in these areas. The exposure assumption used to calculate SSCLs protective of recreational users (hunter) was 16 days, and it unlikely that any recreationalist would be exposed for more than one day given the remote location and difficult terrain associated with these 18 features. In addition, the arsenic (530 mg/kg) and lead (2,608 mg/kg based on 5 ug/dL blood lead level) concentrations that are protective for a hunter, based on the 16 day exposure scenario, are higher than the more conservative site-wide SSCLs. Therefore, warning signs to limit use are effective remedies for protection of human health at these remote features. In these areas, the physical condition of the waste area habitat is so poor that it is unlikely to be used by wildlife. These areas are small, sparsely vegetated, or bare waste piles and they are not appealing habitat when the vast majority of surrounding area is undisturbed forest habitat (TetraTech 2013b). Therefore, it is anticipated that ecological receptors preference for the nearby undisturbed habitat will provide adequate protection for ecological receptors.

The furthest downstream water quality, near the confluence of Stevens Creek and the Blackfoot River in Stevens Creek, does not meet aquatic standards for cadmium, copper, lead, and zinc and sediment exceeds arsenic, copper, and lead. However, the seasonal flows are small (0.0004 to 1.07 cfs), while Blackfoot River flows at the confluence with Stevens Gulch are much larger (8.76 to 36.5 cfs). In addition, Stevens Creek does not make it to the Blackfoot River during drier precipitation periods. The stream intersects highly mineralized areas including the copper-molybdenum ore body (Figure 14), which contributes to metals concentrations in sediment and

surface water. However, the waste removal at the Capital Mine, the largest waste pile sitting in Stevens Creek, improved the sediment and water quality below the mine. The preferred remedy for Stevens Creek sediments for non-federal land is MNR (Alternative 2). Stream sediment data collected pre and post interim action at the Capital Mine indicate that MNR is occurring in Stevens Creek (Table 6). MNR is proposed under these conditions and monitoring will confirm that SSCLs are eventually met. When combined with the Capital Mine source, MNR is a protective remedy for Stevens Creek. It would be difficult to implement an active sediment remedy in this remote, highly mineralized area where runoff across the copper-molybdenum ore body may continue to affect sediment and surface water quality.

11.2 Evaluation of the Preferred Remedy for Soil, Sediment, Groundwater, and Surface Water

11.2.1 Soils (EA 1 and EA 5)

The preferred remedy would remove most metals impacted soils to the SSCLs and place those soils in the on-site UBMC Repository. Removal will greatly reduce risk to human health and the environment. However, some areas at the UBMC are remote and difficult to access. These areas are characterized by steep slopes that are mostly heavily timbered and with few serviceable roads. Many of the old road grades are over grown with trees that are over 40 years old. In addition, some areas like Stevens Gulch are located within the footprint of the UBMC copper-molybdenum ore body. Any new road construction or improvements necessary to turn older roads into haul roads would risk exposing mineralized areas with the potential for increasing human health and environmental problems. In these areas, removal and/or other remedies requiring heavy machinery are not a viable option. These remote areas will be addressed through site-wide elements such as fencing or signage.

The preferred remedy for soils was selected over the other alternatives because it is expected to achieve substantial and long-term risk reduction through excavation and removal to an on-site repository. In the difficult to access mining-related areas, where excavation and removal to an on-site repository are not possible without the potential for causing additional environmental harm, access restrictions will provide limited long-term risk reduction in lieu of the considerable disturbance and increased risk that may be caused by road construction needed to reach these remote areas.

The preferred remedy only applies to that portion of the metals impacted soils on non-federal land as the USFS is responsible for selecting the remedy on federal land.

11.2.2 Sediments (EA 3, EA 4, and EA5)

The preferred remedy would remove most metals impacted sediment associated with the Upper Marsh or mining-related features and place them in the on-site UBMC Repository. The same accessibility challenges found with soils also exists for sediments found in or near the mining-related features. In areas where accessibility is not an issue, sediments would be cleaned up to SSCLs that will enhance the reestablishment of aquatic organisms.

The preferred remedy also includes MNR in areas that are already showing signs of recovery. Ecological indicators such as diversity within the macroinvertebrate community, macroinvertebrate bioassays, and improvement in water quality from upstream to downstream

suggest that the Blackfoot River is recovering below the Upper Marsh. It is anticipated that the western portion of the Upper Marsh will also benefit from the upstream removals that will take place over the next several years. The preferred remedy also includes site-wide elements, such as signage, where contaminated sediments in sensitive environments will remain and may pose a potential risk to human health.

The preferred remedy for streambed sediments was selected over the other alternatives because it is expected to achieve substantial and long-term risk reduction through excavation and removal to an on-site repository. In the difficult to access mining-related areas, where excavation and removal to an on-site repository are not possible without the potential for causing considerable environment harm, access restrictions will provide limited long-term risk reduction in lieu of the considerable disturbance and increased risk that may be caused by road construction needed to reach these remote areas. In specific areas, MNR was selected over the other alternatives and is expected to achieve long-term risk reduction as a result of the source removal in upgradient areas.

The preferred remedy only applies to the portions of the Upper Marsh and mining-related features on non-federal land as the USFS is responsible for selecting the remedy on federal land.

11.2.3 Groundwater (EA 2)

The preferred remedy would continue to address adit discharge and seeps from the Anaconda and Mike Horse mines through active mechanical/physical treatment combined with active chemical reagent at the WTP. Treatment of the Mike Horse adit discharge and seeps would also include the continued treatment of the Upper Mike Horse bedrock groundwater aquifer. Additional improvements to seep capture systems at the Mike Horse Mine, under the ongoing Mike Horse interim action, will deliver some of the worst UBMC source water to the WTP for treatment. Recent data indicates that the WTP, as an ongoing interim action, has improved the surface water quality in that area of the Blackfoot River.

The preferred remedy for the Carbonate Mine groundwater is hydrologic and hydraulic controls combined with a PRB should monitoring demonstrate a potential for near-surface contaminated groundwater to affect the Blackfoot River. The preferred remedy for the Carbonate Mine groundwater and Upper Mike Horse bedrock groundwater is ICs (site-wide elements) in the form of a restrictive covenant, controlled groundwater area, or both.

The preferred remedy for groundwater was selected over the other alternatives because it is expected to achieve substantial risk reduction through treatment of contaminants in the groundwater and provides measures to prevent future exposures to currently contaminated groundwater.

11.2.4 Surface Water

The preferred remedy for mining-related feature discharges, seeps, and/or springs would address surface water quality through containment (retention). The same accessibility challenges found with soils and sediments also exists for discharges, seeps and/or springs found in or near the mining-related features. In areas where accessibility is not an issue, these features would be addressed through the construction of lined retention ponds.

There are no remedial actions proposed to solely address UBMC surface water. Achieving the SSCLs for surface water quality will come from successful implementation of the preferred remedies for soil, sediment, and groundwater that surround the UBMC surface water bodies. Monitoring will evaluate the effectiveness of the remedies for the other media and confirm that SSCLs are met in surface water.

The preferred remedy for the UBMC (soils, sediments, groundwater, and surface water) reduces the risk within a reasonable timeframe and is cost-effective because it affords the highest level of risk reduction compared to cost. The combination of various alternatives in the preferred remedy provides for long-term reliability of the remedy.

Based on the information available at this time, the preferred remedy is protective of public health, safety, and welfare and the environment, would comply with ERCLs, would mitigate risk, would be effective in the short- and long-term, is practicable and implementable, uses some treatment technologies, and is cost-effective. The preferred remedy may be revised in response to public comment or new information. DEQ will identify the selected remedy in the ROD.

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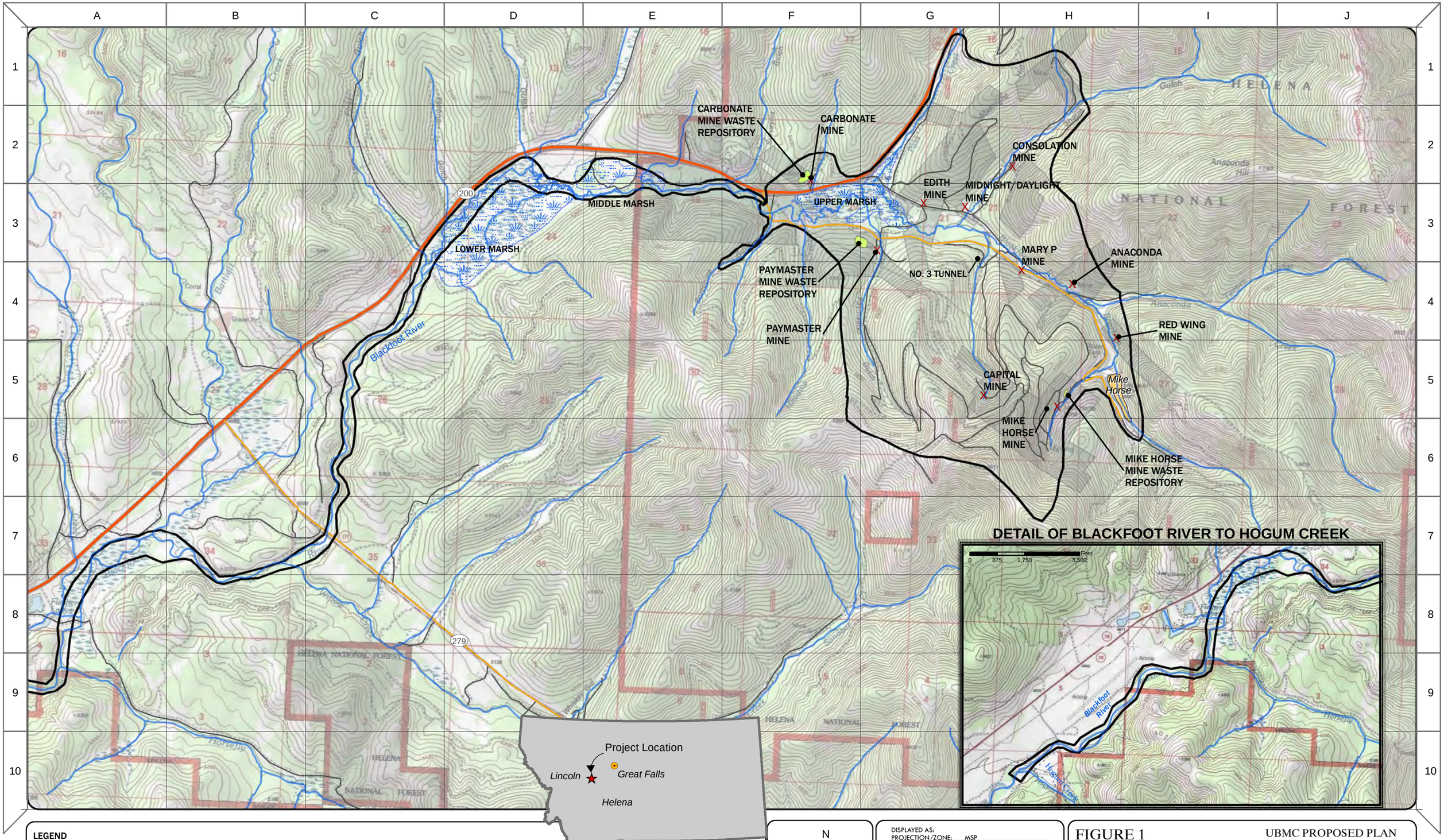

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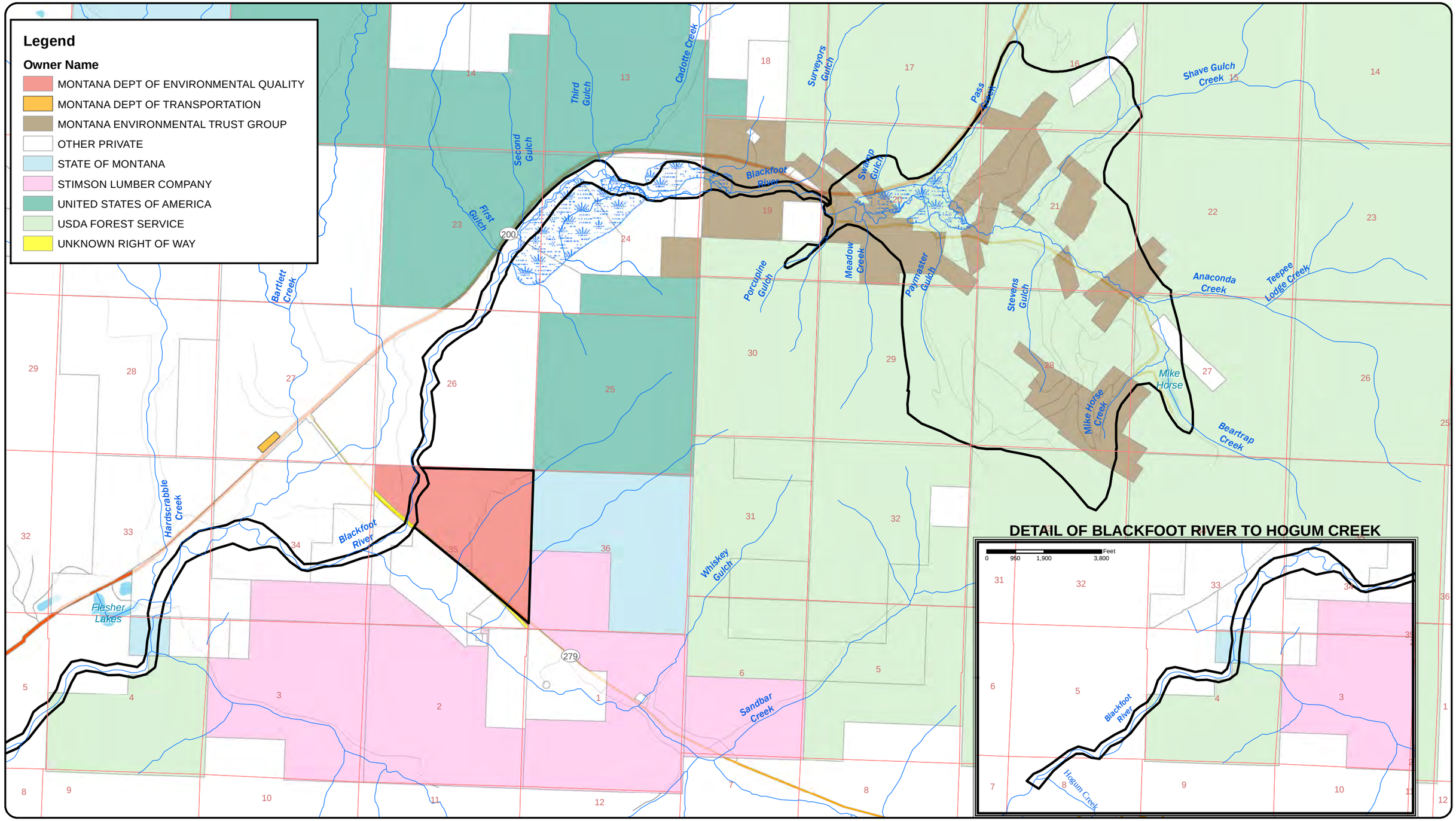


LEGEND

- STREAM
- SECTION LINES
- UBMC Facility Boundary
- MARSH
- LAKE

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 1,500 3,000 6,000
Feet

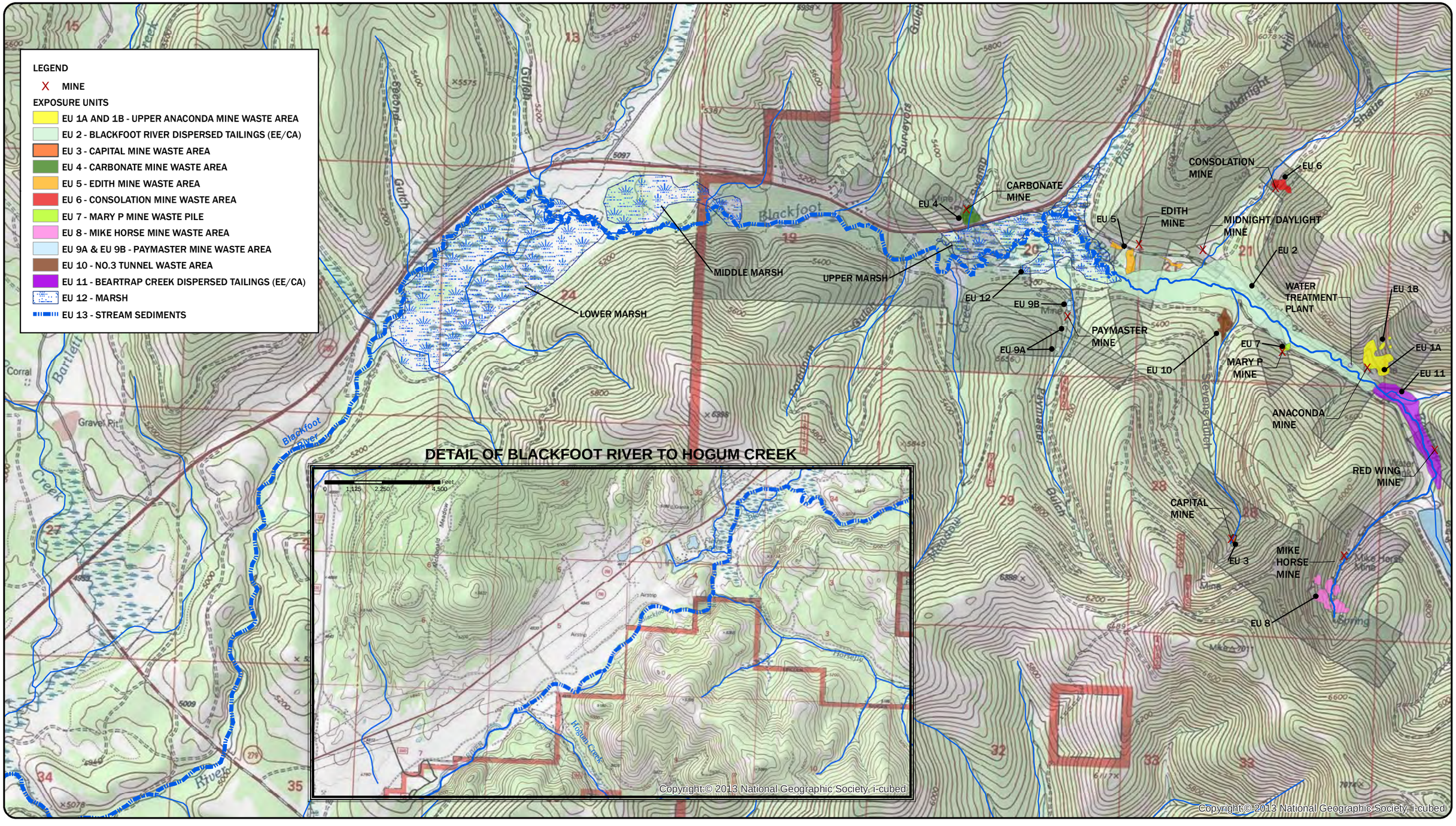
FIGURE 2

PIONEER TECHNICAL SERVICES, INC.

DATE: 8/6/2015

UBMC PROPOSED PLAN
LAND OWNERSHIP AND
SURFACE WATER

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-002-15_08042015.mxd



LEGEND

- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- STREAM
- FOREST SERVICE
- METG/PRIVATE
- LAKE

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 1,000 2,000 4,000
Feet

FIGURE 3

UBMC PROPOSED PLAN
EXPOSURE UNIT
LOCATIONS

PIONEER TECHNICAL SERVICES, INC.

DATE: 10/7/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-005-15_Editedto_Fig3_08042015.mxd

UAW3-COMP1(0-6)
EU 1B
UAW5-300+75(0-6)
EU 1B
UAW1-50+50(0-6)
UAW1-00(0-6)
UAW1-50(0-6)
UAW1-00+25(0-6)
UAW5-350(0-6)
UAW5-300(0-6)
UAW1-COMP1(0-6)
UAW4-COMP1(0-6)
UAW1-100(0-6)
UAW5-400(0-6)
UAW5-250(0-6)
UAW1-150(0-6)
EU 1B
UAW5-250+50(0-6)
UAW1-150+75(0-6)
UAW5-200(0-6)
UAW5-450(0-6)
UAW5-150(0-6)
UAW5-150+50(0-6)
UAW5-COMP1(0-6)
UAW5-500+50(0-6)
UAW5-100(0-6)
UAW5-500(0-6)
UAW5-100+25(0-6)
UAW2-100+250(0-6)
UAW5-50(0-6)
UAW2-250+50(0-6)
UAW5-550(0-6)
UAW2-200-(0-6)
UAW5-00(0-6)
UAW2-150-(0-6)
WATER TREATMENT PLANT
UAW5-600(0-6)
UAW2-250-(0-6)
DISCHARGE/OUT FALL
UAW2-300(0-6)
UAW2-100(0-6)
UAW2-350(0-6)
EU 1A
UAW2-COMP1(0-6)
UAW2-350+50(0-6)
UAW2-50(0-6)
ANMW-7
UAW2-400(0-6)
ANACONDA MINE
UAW2-00(0-6)
UAW2-450(0-6)
UAW2-450+50(0-6)
CELL 5
UAW2-400+150(0-6)
UAW2-00+225(0-6)
Blackfoot River
CELL 4
ANMW-3
UAW2-1000(0-6)
MIKE HORSE MINE ROAD
CELL A
ANWS-1

LEGEND

- MINE
- 2007 SAMPLES
- 2008 SAMPLES
- ESTIMATED EXTENT OF MINE WASTE AREA
- UNRECLAIMED MINE WASTE AREA
- FORMER WETLAND TREATMENT CELLS
- MINE WASTE REMOVAL/RECLAIMED AREA
- STREAM

Type

- MONITORNG WELL - ALLUVIAL

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

Feet
0 70 140 280

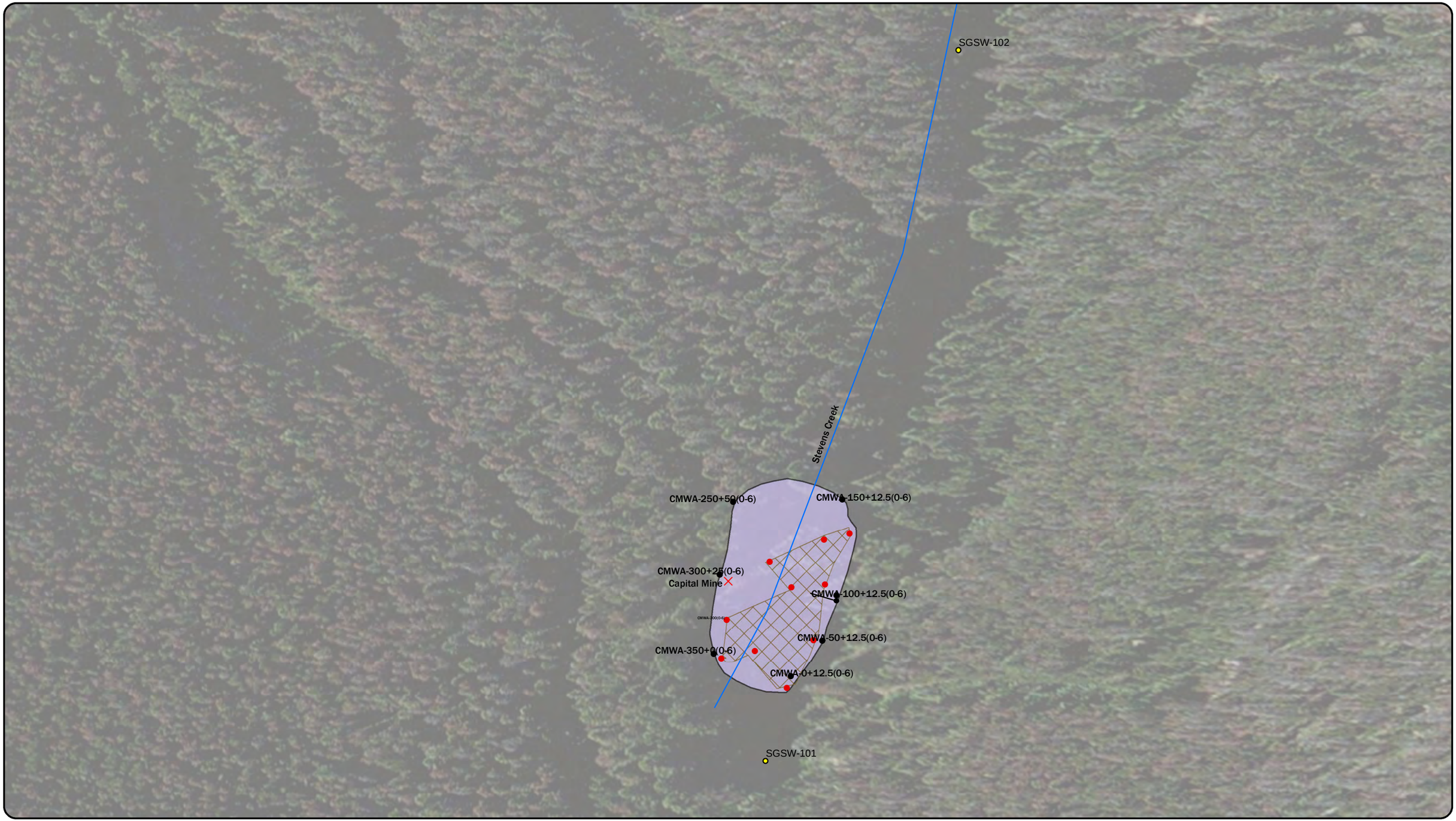
FIGURE 4

UBMC PROPOSED PLAN
EU 1A AND EU 1B UPPER ANACONDA
MINE WASTE PILES
SOIL SAMPLE LOCATIONS

PIONEER TECHNICAL SERVICES, INC.

DATE: 8/9/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-011-15_Editedto_Fig4_08042015.mxd



LEGEND

- MINE
- 2007 SAMPLE
- 2008 SAMPLE
- ESTIMATED EXTENT OF MINE WASTE AREA
- MINE WASTE REMOVAL/RECLAIMED AREA
- STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 45 90 180 Feet

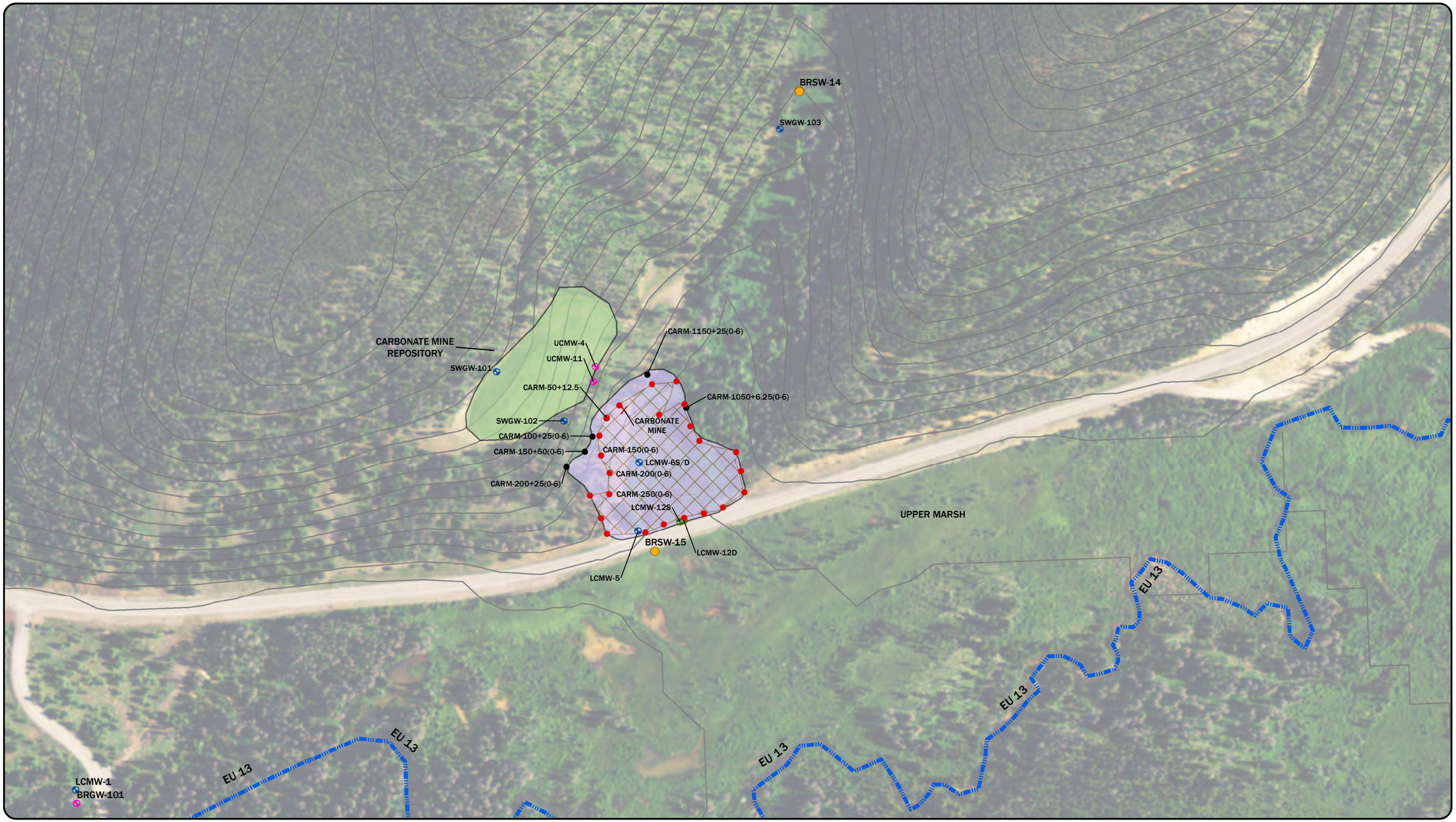
FIGURE 5

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 3 CAPITAL MINE WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-016-15_Edited to_Fig5_08042015.mxd



LEGEND

- MINE
- SURFACE WATER SAMPLING LOCATION
- 2007 SAMPLE
- 2008 SAMPLE
- STREAM (EU 13)
- MONITORING WELL - ALLUVIAL/BEDROCK PAIR
- MONITORING WELL - ALLUVIAL
- MONITORING WELL - BEDROCK
- ESTIMATED EXTENT OF MINE WASTE AREA
- MINE WASTE REMOVAL/RECLAIMED AREA
- MINE WASTE REPOSITORY

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 130 260 520 Feet

FIGURE 6

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 4 CARBONATE
MINE WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-032-15_EditedTo_Fig6_08042015.mxd

LEGEND

- MINE
- 2007 SAMPLE
- ESTIMATED EXTENT OF MINE WASTE AREA
- STREAM
- Groundwater Wells

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 65 130 260 Feet

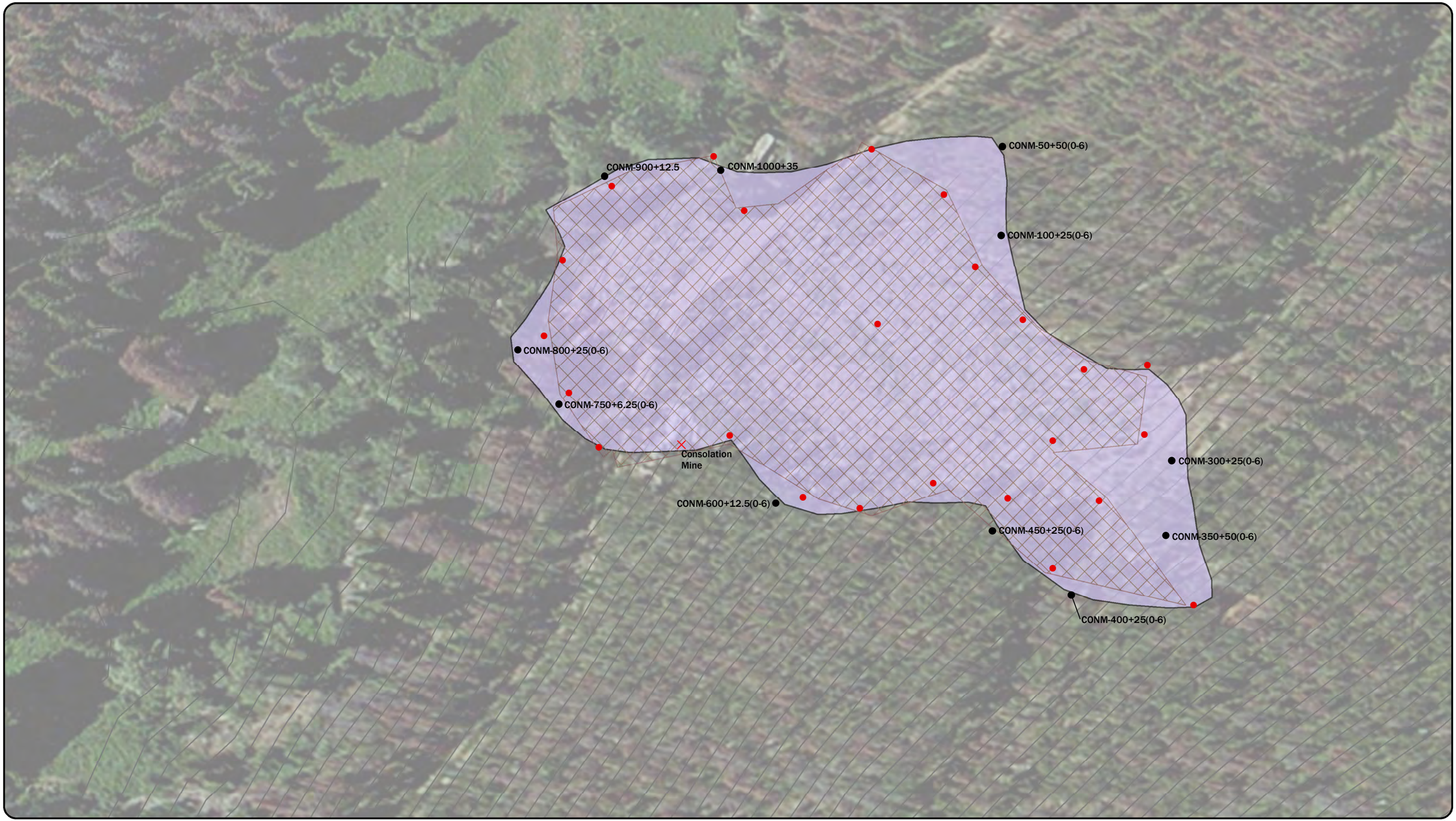
FIGURE 7

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 5 EDITH MINE WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-012-15_EditedTo_Fig7_08042015.mxd



LEGEND

- MINE
- 2007 SAMPLE
- 2008 SAMPLE
- ESTIMATED EXTENT OF MINE WASTE AREA
- MINE WASTE REMOVAL/RECLAIMED AREA

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 35 70 140 Feet

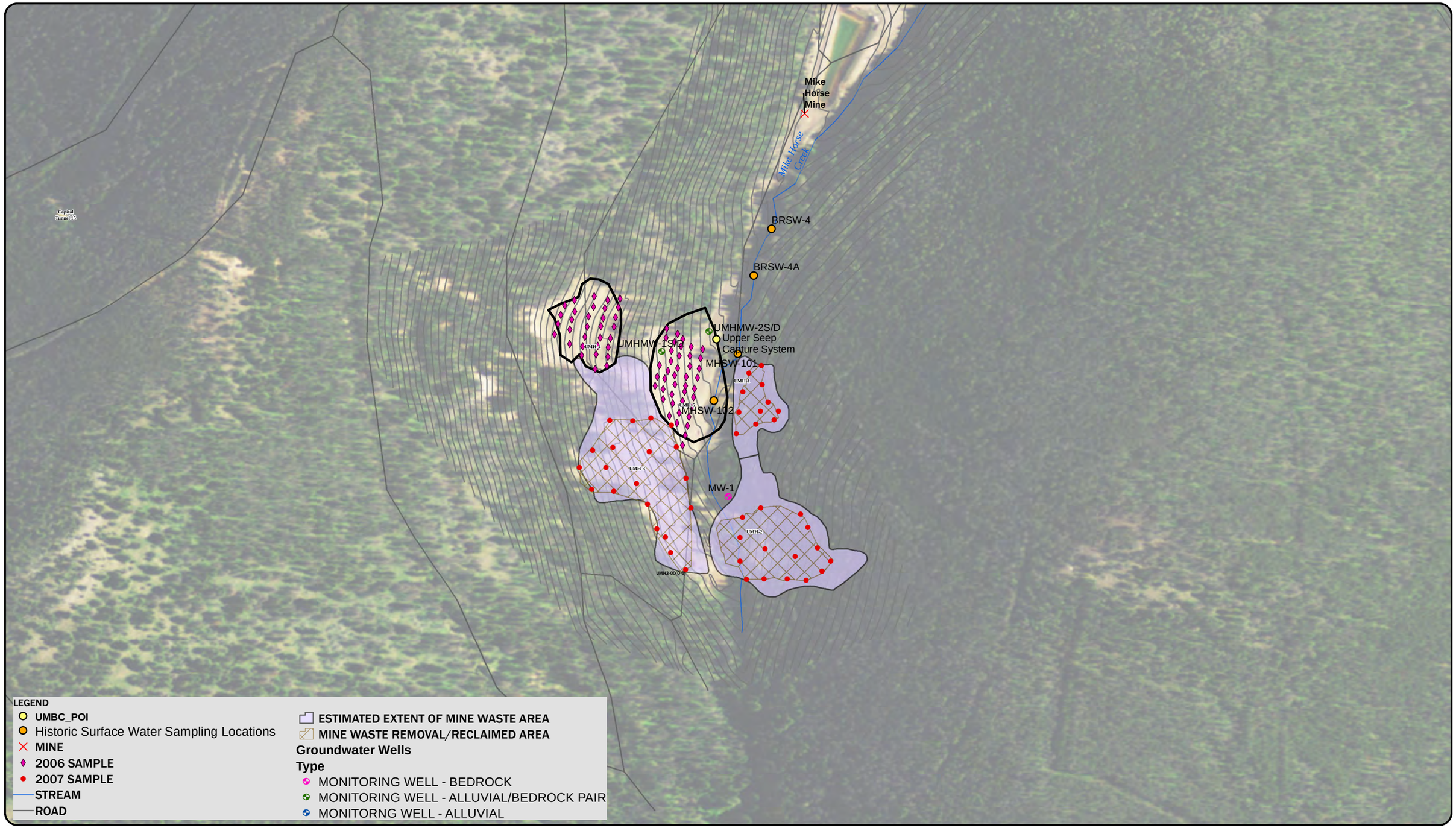
FIGURE 8

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 6 CONSOLATION MINE WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-013-15_EditedTo_Fig8_08042015.mxd



NOTE:
THE 2006 HYDROMETRICS SAMPLING LOCATIONS (DIAMONDS) ARE NOT OUTSIDE THE EXTENT OF MINE WASTE AREA; THESE TWO AREAS (UMH-4 AND UMH-5)WERE NOT INCLUDED IN THE 2007 AND 2008 RI THAT DEFINED THE ESTIMATED EXTENT OF THE MINE WASTE AREAS FOR UMH-1, UMH-2, UMH-3.

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 80 160 320 Feet

FIGURE 9a

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 8 UPPER MIKE HORSE MINE
WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 10/7/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-025-15_EditedTo_Fig9a_10072015.mxd

N

0 80 160 320 Feet

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

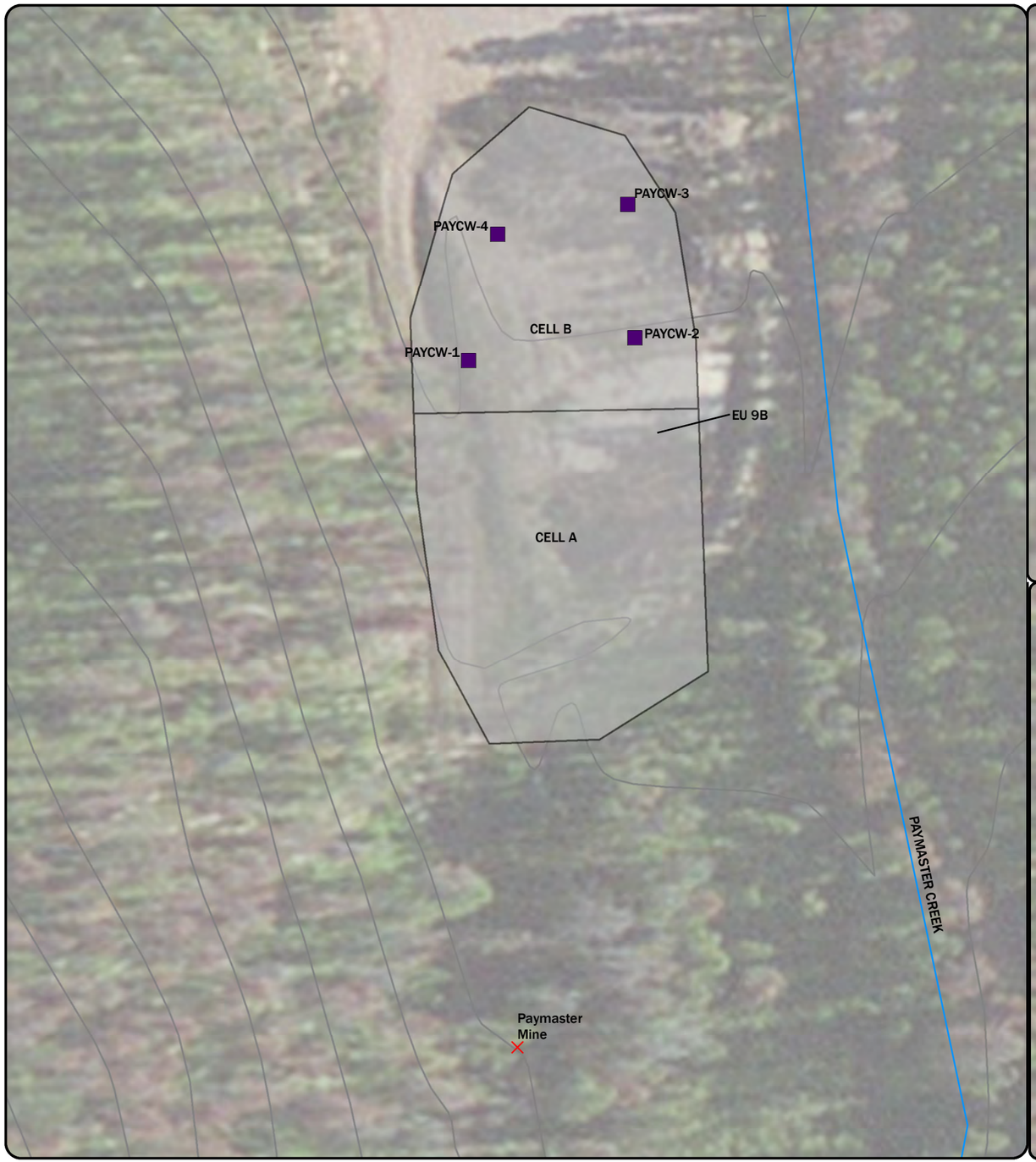
FIGURE 9b

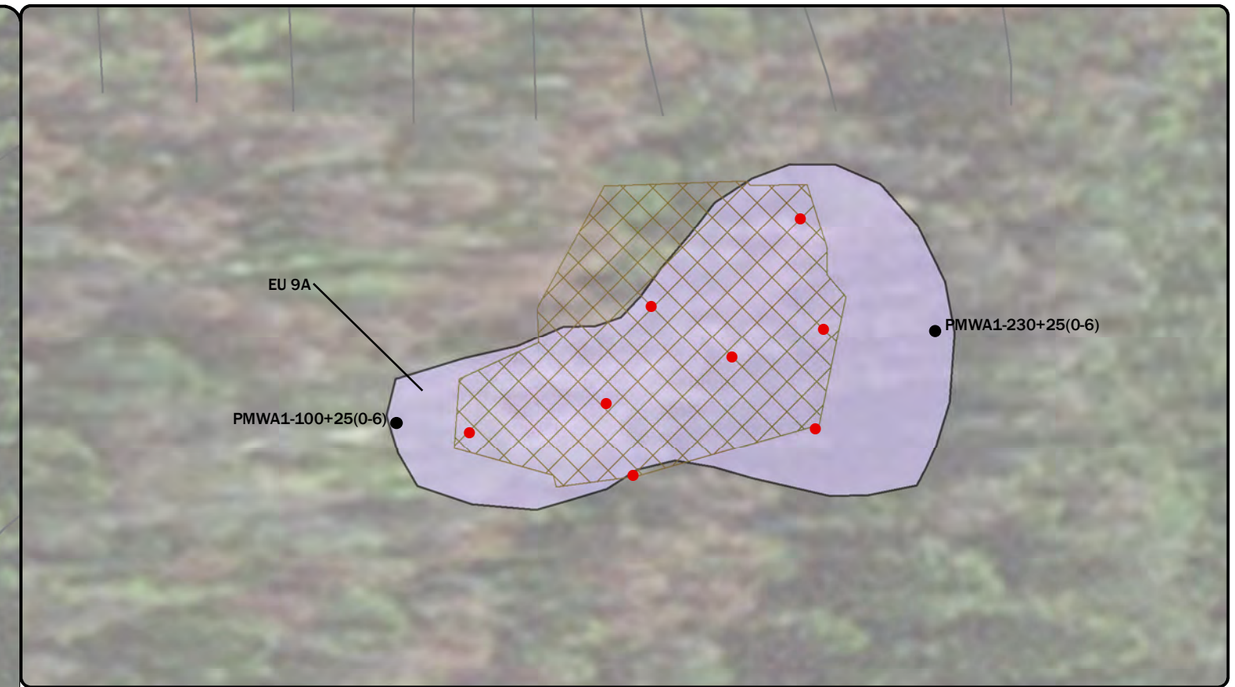
PIONEER TECHNICAL SERVICES, INC.

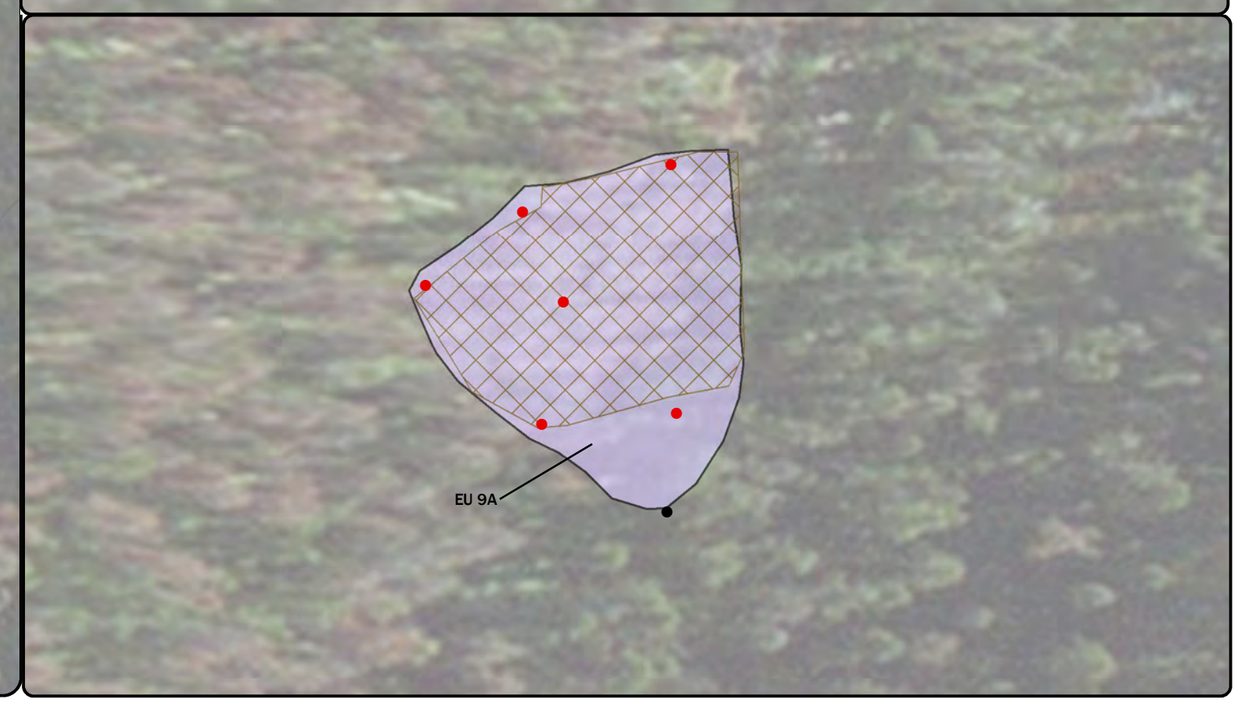
DATE: 10/7/2015

UBMC PROPOSED PLAN
EU 8 MIKE HORSE MINE
GROUNDWATER SAMPLE
LOCATIONS

Path: K:\GIS\Project\UBMC_FS-GI-PLN-026-15_Fig9b_10072015.mxd







LEGEND

- MINE
- 2007 SAMPLE
- 2008 SAMPLE
- PAYMASTER SUBSURFACE SOIL SAMPLE
- ESTIMATED EXTENT OF MINE WASTE AREA
- CONSTRUCTED WETLAND TREATMENT CELLS
- MINE WASTE REMOVAL/RECLAIMED AREA
- STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 25 50 100 Feet

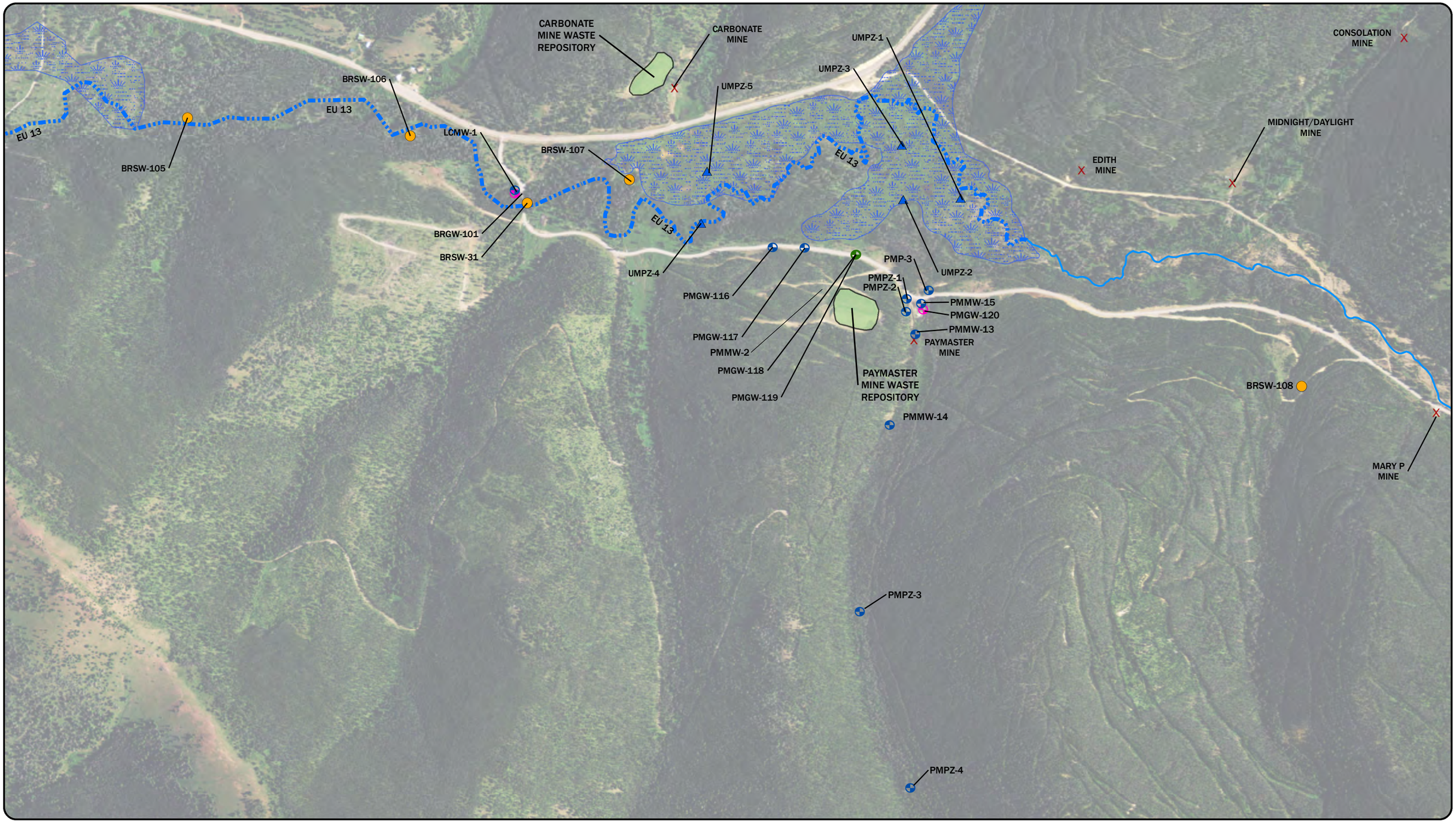
FIGURE 10

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 9A AND EU 9B PAYMASTER
MINE WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-017-15_Editedto_Fig10_08042015.mxd



LEGEND

- MINE
- 2007 AND/OR 2008 SURFACE WATER SAMPLING LOCATION
- 2011 SURFACE WATER SAMPLING LOCATION
- SURFACE WATER SAMPLE LOCATION
- 2008 ALLUVIAL PIEZOMETER
- GROUNDWATER SAMPLE LOCATION - ALLUVIAL/BEDROCK PAIR
- GROUNDWATER SAMPLE LOCATION - ALLUVIAL
- GROUNDWATER SAMPLE LOCATION - BEDROCK
- STREAM
- STREAM (EU 13)
- MARSH
- MINE WASTE REPOSITORY

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 400 800 1,600
Feet

FIGURE 11

PIONEER TECHNICAL SERVICES, INC.

DATE: 8/9/2015

UBMC FEASIBILITY STUDY
PAYMASTER GULCH
AQUIFER GROUNDWATER
SAMPLE LOCATIONS

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-047-15_EditToFig11_08042015.mxd

LEGEND

- MINE
- 2007 SAMPLE
- Mine Waste Removal/Reclaimed Area
- ESTIMATED EXTENT OF MINE WASTE AREA

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 55 110 220 Feet

FIGURE 12

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EU 10 NO. 3 TUNNEL WASTE AREA
SOIL SAMPLE LOCATIONS

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\Fig12_08042015.mxd

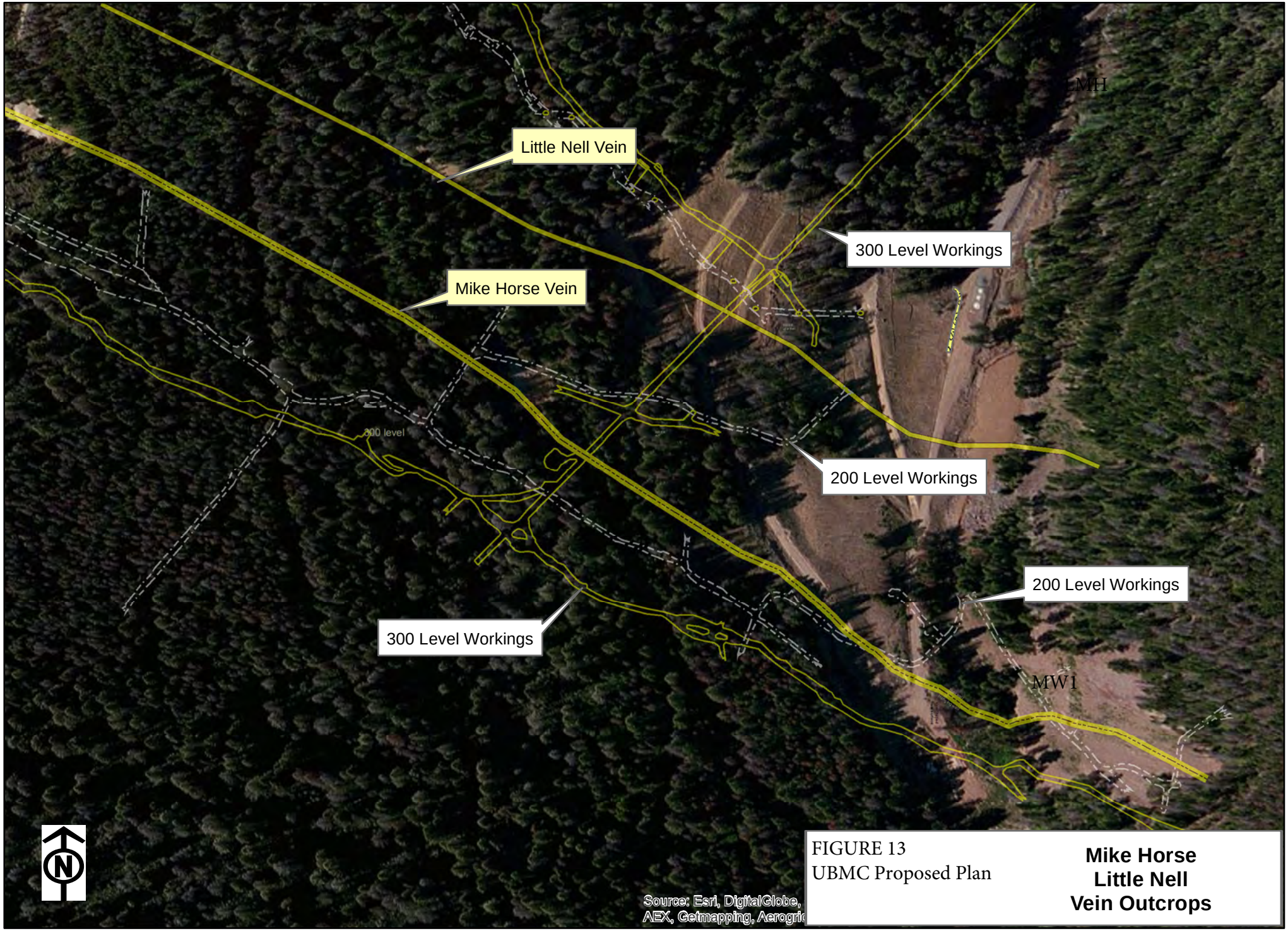
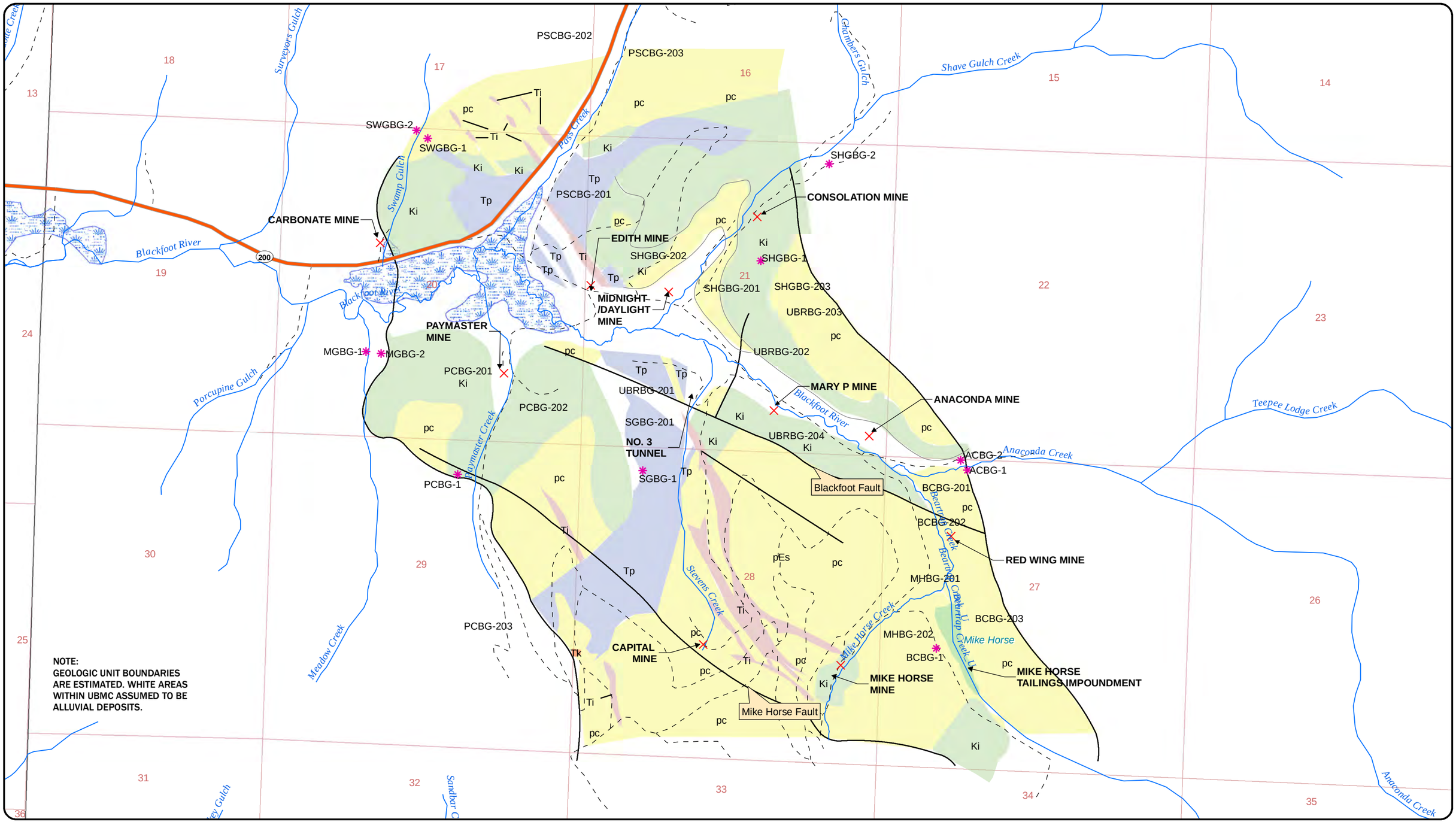


FIGURE 13
UBMC Proposed Plan

Mike Horse Little Nell Vein Outcrops

0 50 100 200 300 400 Feet 1 in = 150 ft

Author: Donald Sutton P.E.
Vein Outcrops.mxd
5/8/2015



LEGEND

- BACKGROUND SOIL SAMPLE
- MINE
- FAULT
- LOCAL ROAD
- STATE HIGHWAY
- Ki DIORITE (GABBFRO) SILL
- Ti QUARTZ MONZONITE PORPHYRY DIKES
- Tk KLEINSCHMIDT BRECCIA PIPE
- Tp QUARTZ MONZONITE PORPHYRY AND QUARTZ PORPHYRY
- pc SPOKANE SHALE (BELT SUPERGROUP)
- MARSH
- STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 650 1,300 2,600 Feet

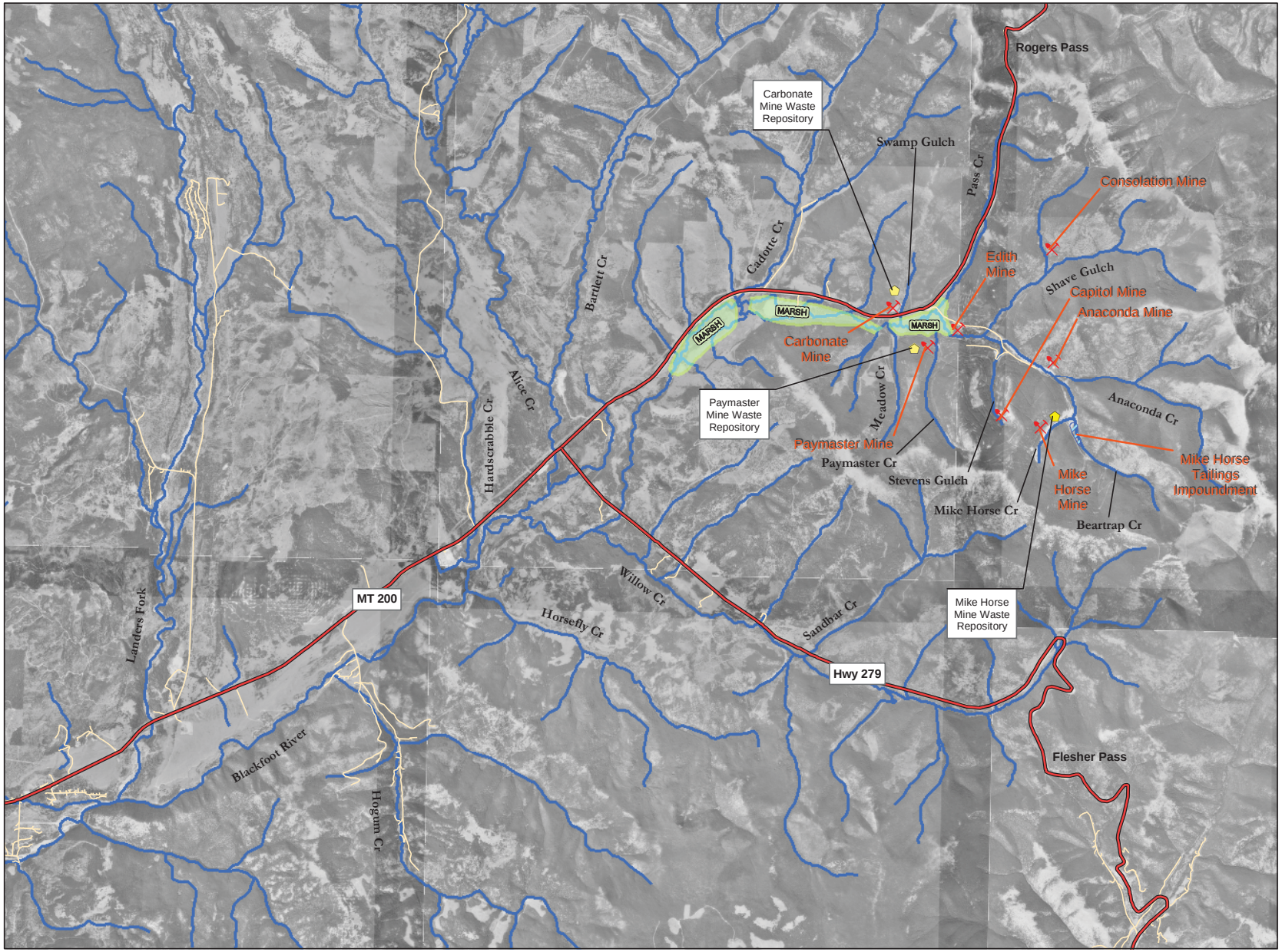
FIGURE 14

UBMC PROPOSED PLAN
GEOLOGIC MAP

PIONEER TECHNICAL SERVICES, INC.

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-003-15_Editedto_Fig14_08042015.mxd

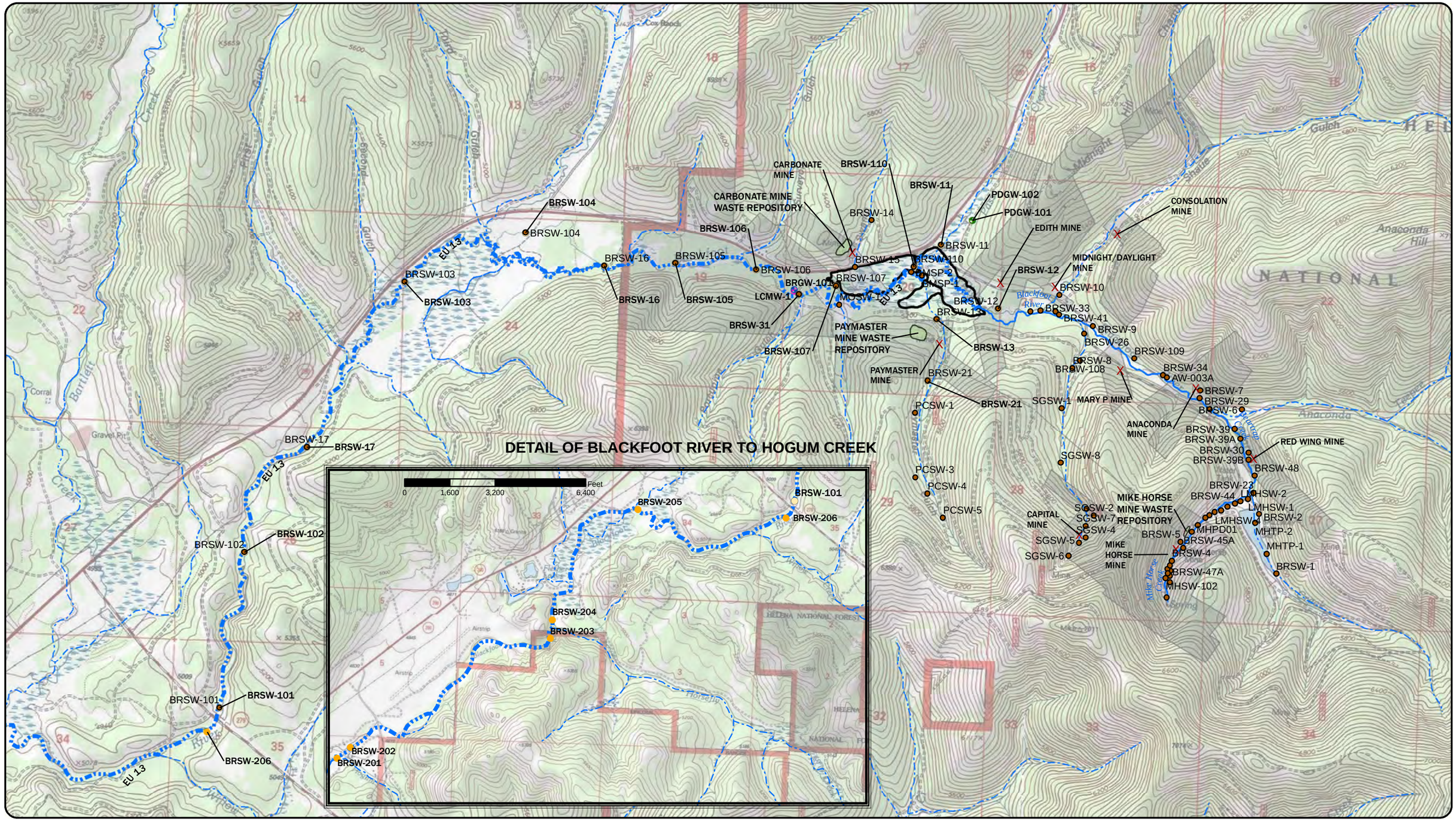


Hydrometrics, Inc
Consulting Scientists and Engineers

0 0.5 1 Miles

Figure 15 UBMC Proposed Plan: Upper Blackfoot River Surface Water Drainage Network

K:\PROJECT\1290\2005 DEQ DATA COMPILATION\GIS\AREAMAP.MXD



LEGEND:

- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- STREAM
- FOREST SERVICE PROPERTY BOUNDARY
- METG/PRIVATE
- LAKE
- MINE
- EU 13 STREAM
- MINE WASTE REPOSITORY
- 2007/2008 SAMPLE LOCATION (SEDIMENT AND SURFACE WATER)
- 2011 SAMPLE LOCATION (SEDIMENT AND SURFACE WATER)

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 1,100 2,200 4,400
Feet

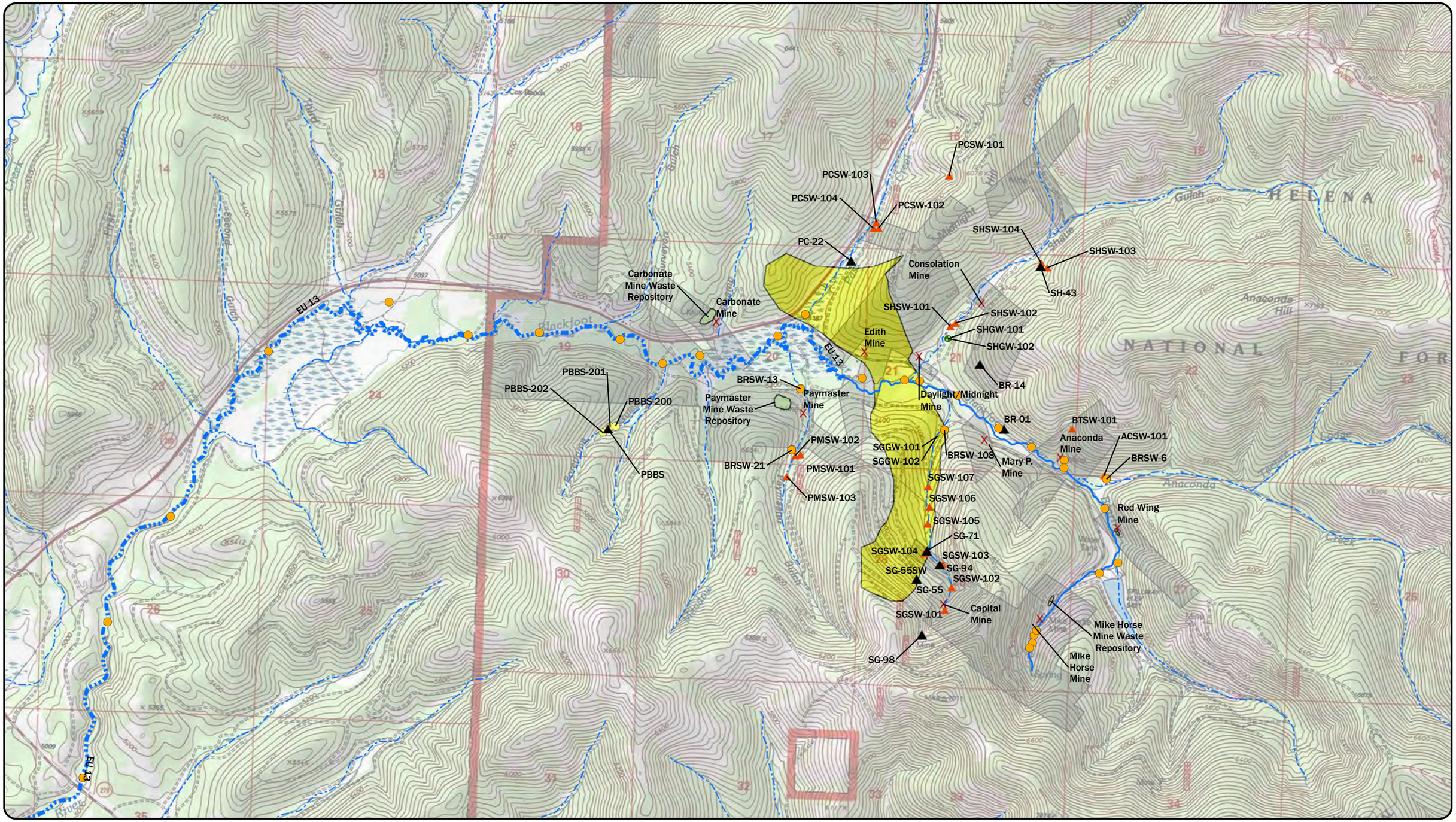
FIGURE 16

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
BLACKFOOT RIVER
SURFACE WATER AND SEDIMENT
SAMPLE LOCATIONS

DATE: 10/7/2015

Path: K:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-043-15_Editedto_Fig16_08042015.mxd



LEGEND:
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- LAKE
- METG/PRIVATE
- FOREST SERVICE PROPERTY BOUNDARY
- 2011 SURFACE WATER SAMPLE LOCATIONS
- SURFACE WATER SAMPLE LOCATION
- 2007 AND/OR 2008 SURFACE WATER SAMPLING LOCATION
- MINE
- MINE WASTE REPOSITORY
- MINING RELATED SAMPLE LOCATION
- EU 13 STREAM

Type
- MONITORING WELL - ALLUVIAL/BEDROCK PAIR
- Approximate Boundary of Copper & Molybdenum Ore Body

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 1,100 2,200 4,400
Feet

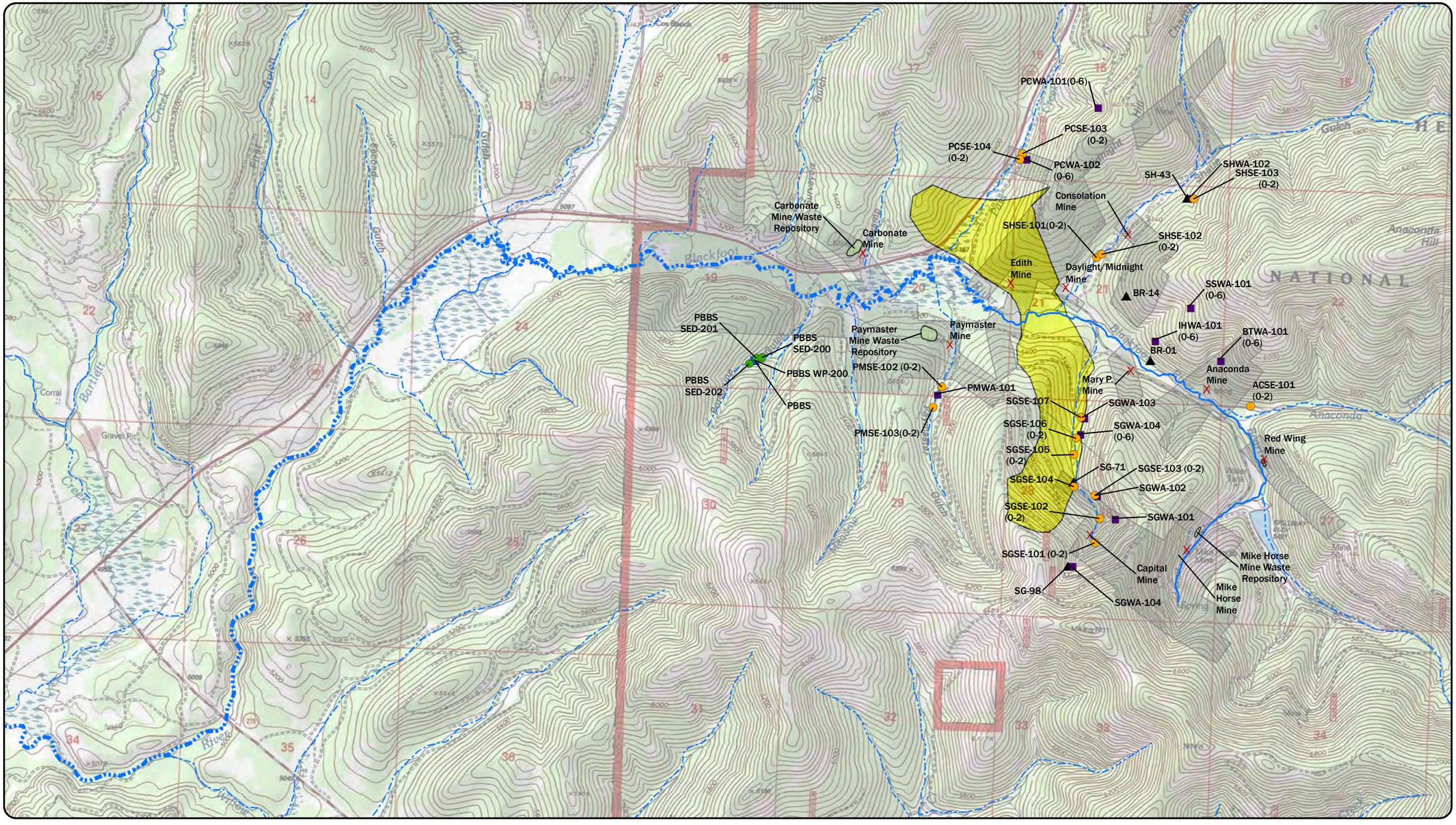
FIGURE 17

PIONEER TECHNICAL SERVICES, INC.

DATE: 10/8/2015

UBMC PROPOSED PLAN
EA 3 MINING RELATED
FEATURES SURFACE WATER
SAMPLE LOCATIONS

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-052-15_Editedto_Fig17_10072015.mxd



LEGEND:

- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- LAKE
- METG/PRIVATE
- FOREST SERVICE PROPERTY BOUNDARY
- Approximate Boundary of Copper & Molybdenum
- MINE
- MINE WASTE REPOSITORY
- 2008 MINE INVENTORY SEDIMENT SAMPLE LOCATIONS
- 2008 MINE INVENTORY MINE WASTE SAMPLE LOCATIONS
- 2011 MINE INVENTORY SEDIMENT SAMPLE LOCATIONS
- 2011 MINE INVENTORY MINE WASTE SAMPLE LOCATIONS
- MINING RELATED SAMPLE LOCATIONS
- EU 13 STREAM

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 1,100 2,200 4,400
Feet

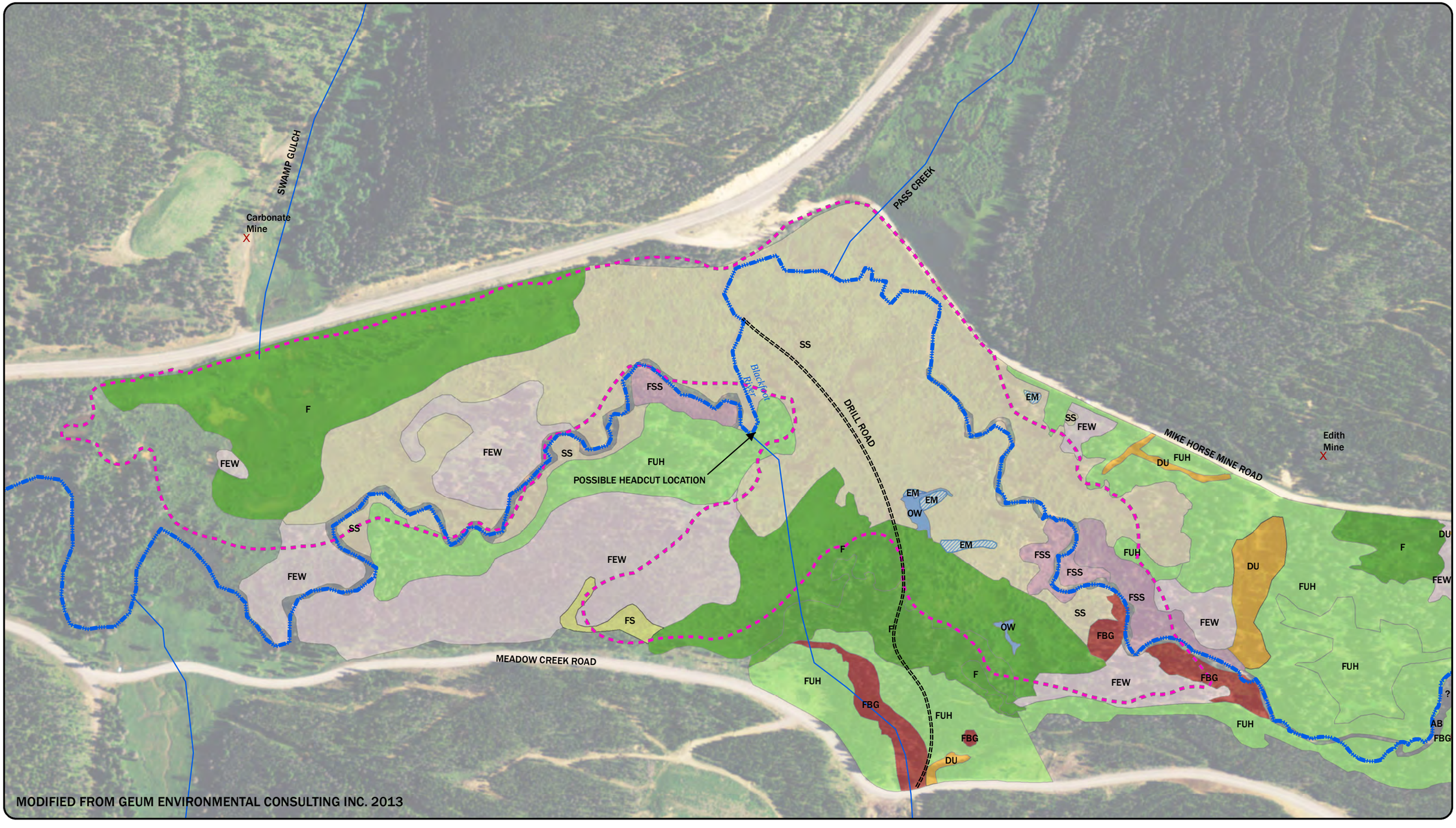
FIGURE 18

UBMC PROPOSED PLAN
EA 3 MINING RELATED FEATURES
SEDIMENT SAMPLE LOCATIONS

PIONEER TECHNICAL SERVICES, INC.

DATE: 10/8/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-052-15_Editedto_Fig17_ EditedtoFig1810072015.mxd



LEGEND

DU	DISTURBED UPLAND	FSS	FILLED SCRUB SHRUB	FS	FORESTED SHRUB WETLAND	SS	SHRUB WETLAND
EM	EMERGENT MARSH	FBG	FORESTED BARE GROUND	FUH	FORESTED UPLAND HERBACEOUS	====	DRILL ROAD
F	FEN	FEW	FORESTED EMERGENT WETLAND	OW	OPEN WATER		STREAM

MARSH BOUNDARY (EU 12)
X MINE
STREAM - EU 13

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/GEUM/ESRI

0 125 250 500 Feet

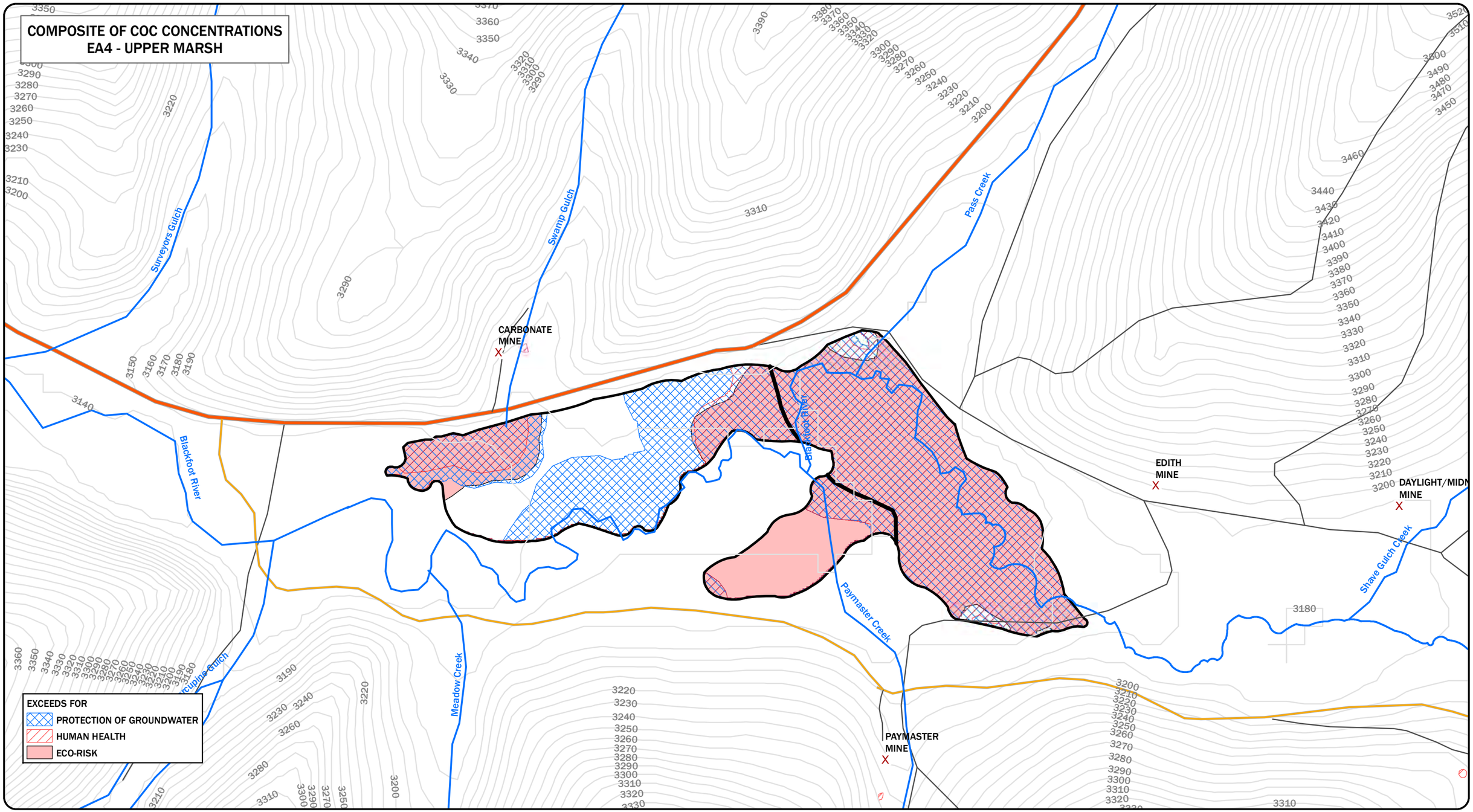
FIGURE 19

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EA 4 MARSH
VEGETATION MAPPING

DATE: 8/14/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-036-15_EditedTo_Fig19_08042015.mxd



LEGEND

X MINES
STREAM
HIGHWAY
MAJOR ROAD
LOCAL ROAD

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 250 500 1,000
Feet

FIGURE 20

PIONEER TECHNICAL SERVICES, INC.

DATE: 8/14/2015

UBMC PROPOSED PLAN
EA4-UPPER MARSH
AREAS EXCEEDING SSCLS - COMBINED

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-041-15_Editedto_Fig20_08042015.mxd

LEGEND

- GW_SampLocs
- MINE
- STREAM
- MINE WASTE REPOSITORY
- MONITORING WELL - ALLUVIAL/BEDROCK PAIR
- MONITORING WELL - ALLUVIAL
- MONITORING WELL - BEDROCK

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 200 400 800
Feet

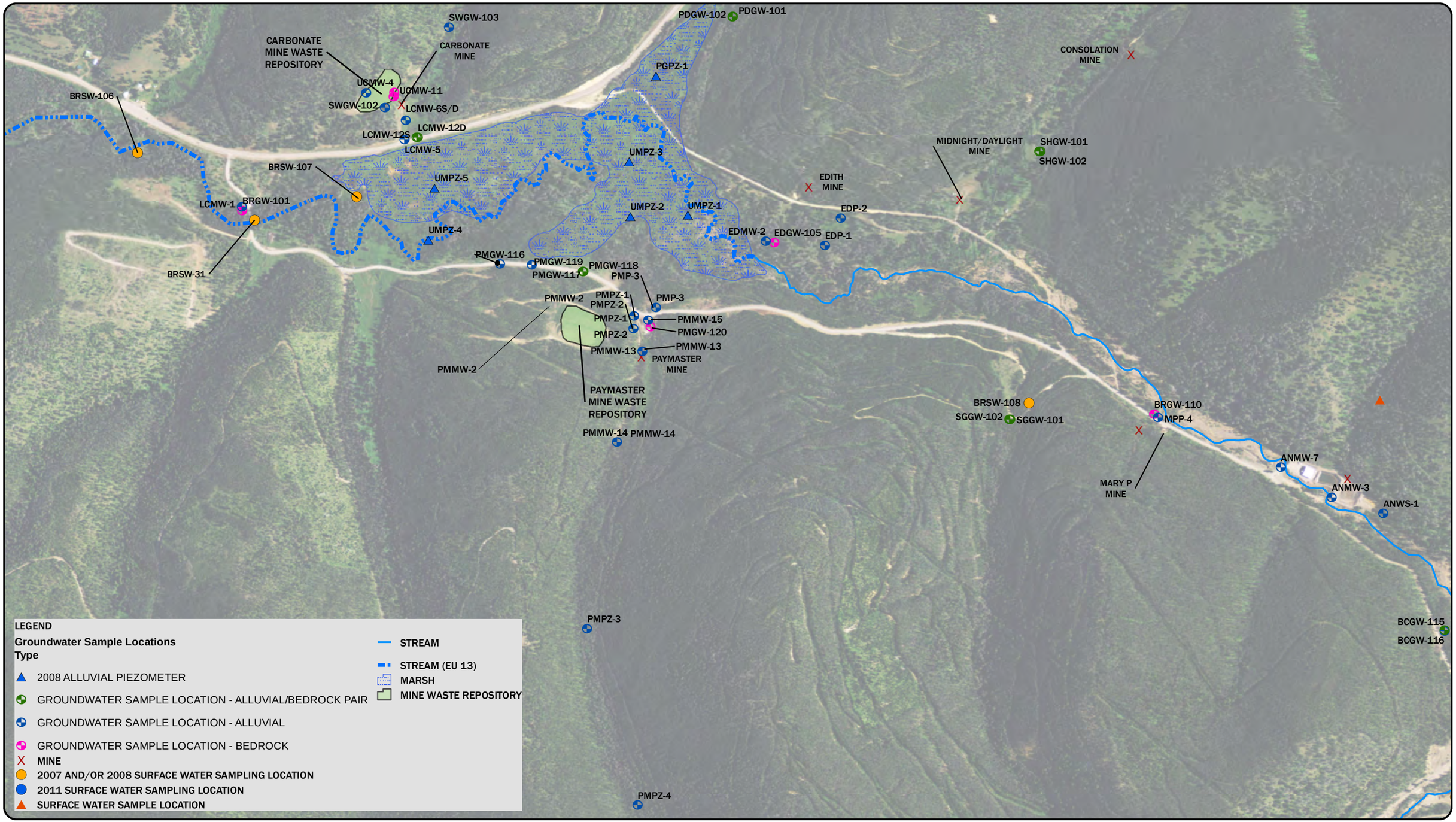
FIGURE 21

UBMC PROPOSED PLAN
MIKE HORSE CREEK/BEARTRAP CREEK GROUNDWATER MONITORING LOCATIONS

PIONEER TECHNICAL SERVICES, INC.

DATE: 8/9/2015

Path: E:\GIS\Project\Edited_08042015\UBMC_FS-GI-PLN-026-15_FigGroundwaterBear_MikeHorse_fIG21_08042015.mxd



N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 400 800 1,600
Feet

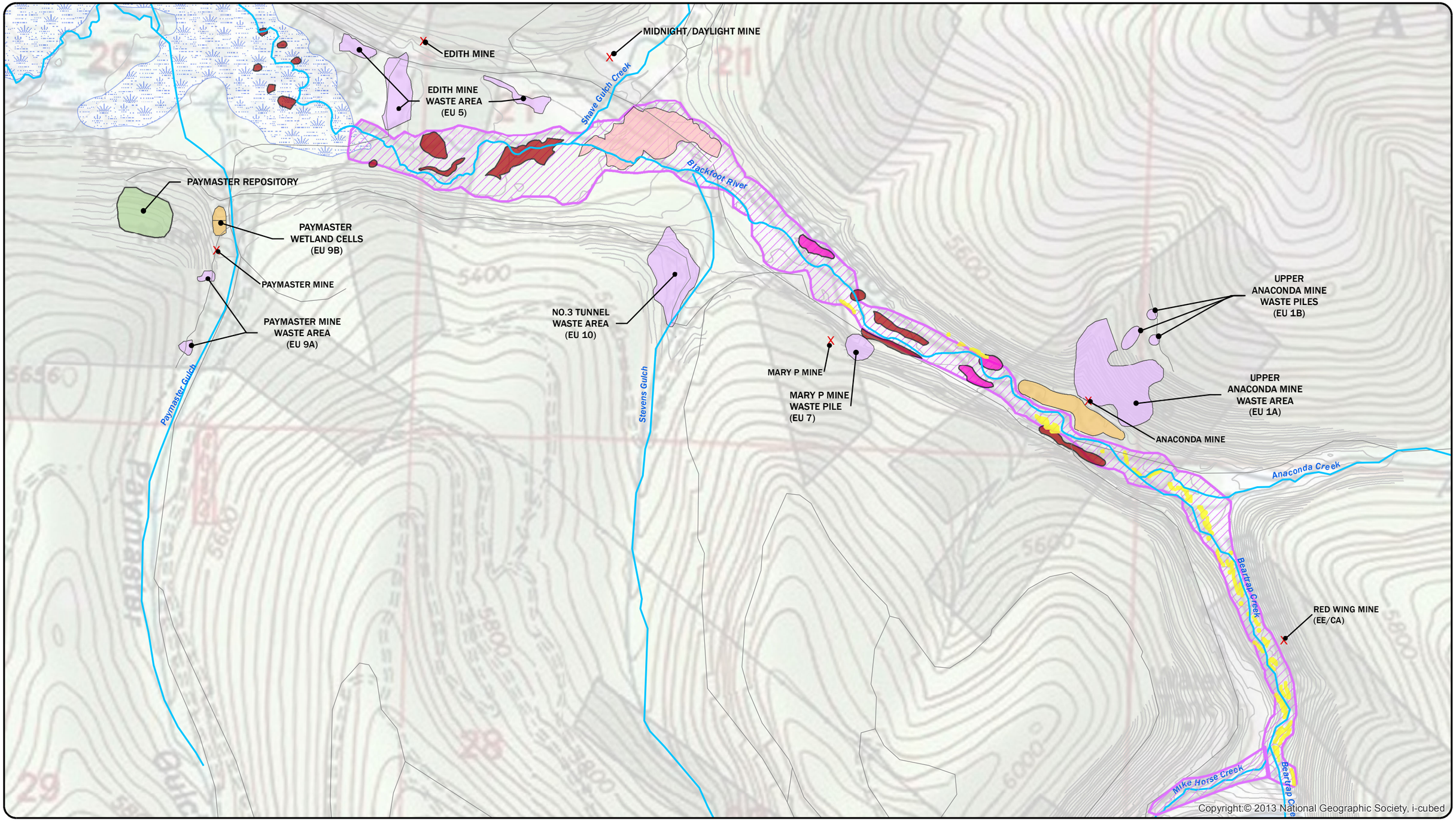
FIGURE 22

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
BLACKFOOT RIVER AND TRIBUTARIES GROUNDWATER SAMPLING LOCATIONS

DATE: 10/7/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-047-15_Fig23_EditToFig22_10072015.mxd



LEGEND

- MINE
- STREAM
- ROAD
- 1975 BREACH FLOOD STAGE INDICATORS
- AREA OF CONCENTRATED TAILINGS/MINE WASTE
- AREA OF DISPERSED COARSE-GRAINED TAILINGS
- AREA OF DISPERSED SANDY (FINE) TAILINGS
- FORMER WETLAND TREATMENT CELLS
- MINE WASTE REPOSITORY
- ESTIMATED EXTENT OF RIVER FLOODPLAIN SEDIMENTS FROM EE/CA AND RI
- FOREST SERVICE
- METG

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/GEUM/ESRI

0 265 530 1,060 Feet

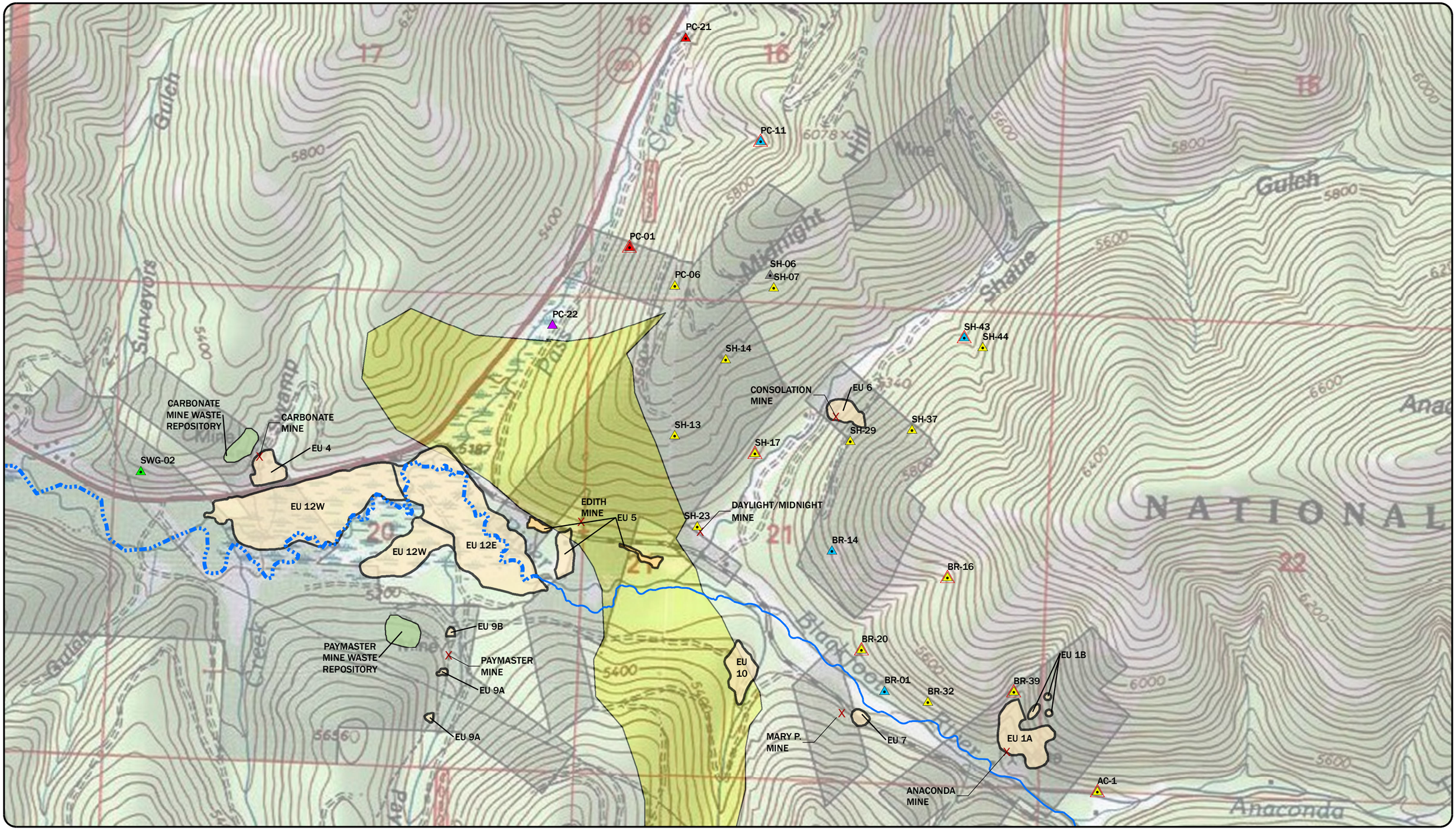
FIGURE 23

UBMC FEASIBILITY STUDY
EE/CA OVERLAP AREA

PIONEER TECHNICAL SERVICES, INC.

DATE: 10/7/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-008-15_Fig23_10072015.mxd



LEGEND

- EXPOSURE UNITS
- MINE WASTE REPOSITORY
- METG/PRIVATE
- Approximate Boundary of Copper & Molybdenum Ore Body
- SAMPLE COLLECTED
- COLLAPSED ADIT WITH DISCHARGE
- COLLAPSED ADIT WITH WASTE ROCK
- COLLAPSED ADIT WITH WASTE ROCK AND DISCHARGE
- DISTURBED AREA
- DISTURBED AREA WITH DISCHARGE
- PHYSICAL HAZARD
- PHYSICAL HAZARD WITH WASTE ROCK
- SURFACE WATER/SEDIMENT
- MINE
- STREAM
- STREAM (EU 13)

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 500 1,000 2,000
Feet

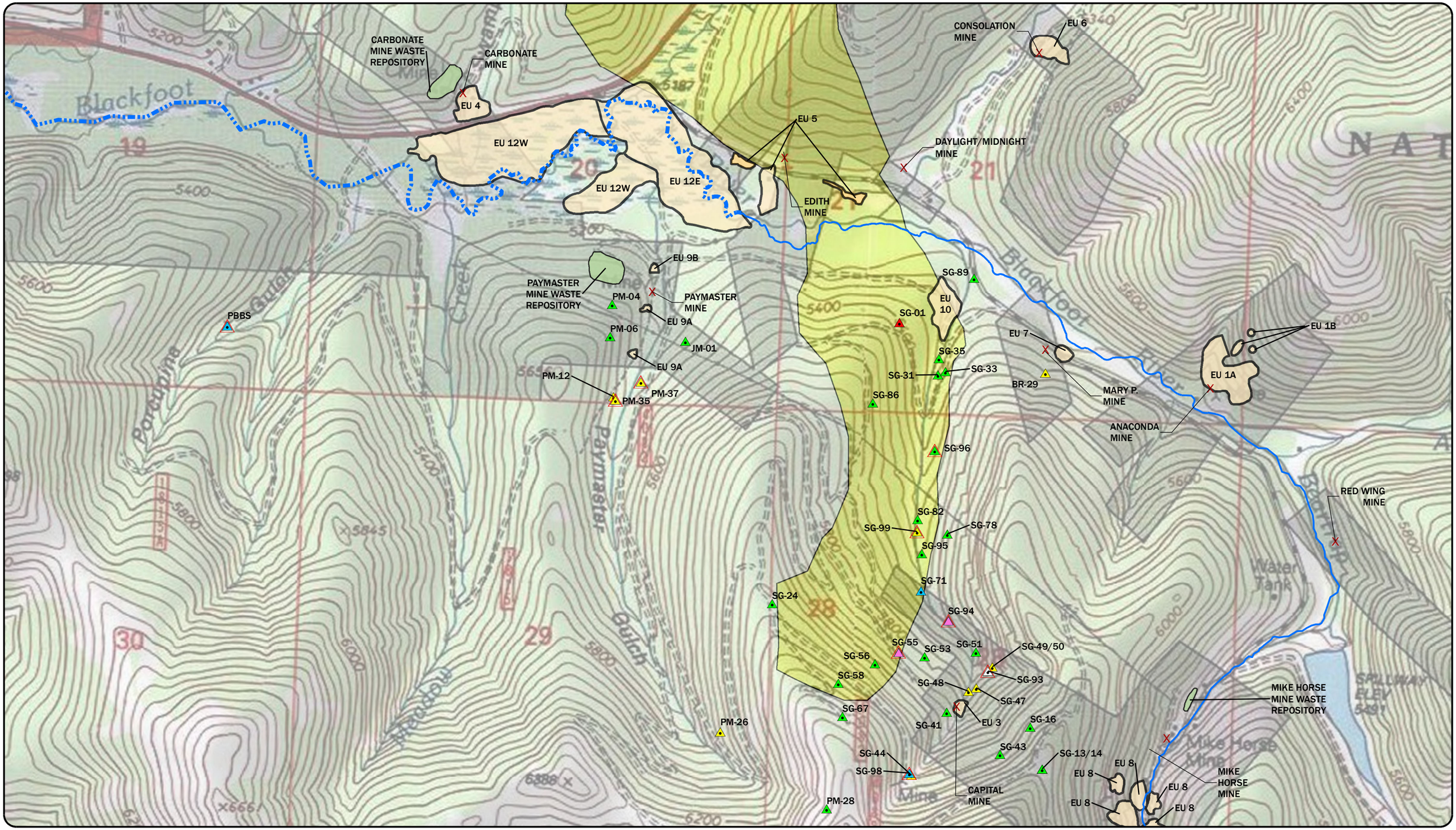
FIGURE 24

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EA5 MINING-RELATED
FEATURE LOCATIONS
NORTH OF BLACKFOOT RIVER

DATE: 10/8/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-048-15_EditedTo_Fig24_10072015.mxd



LEGEND

- EXPOSURE LIMITS
- MINE WASTE REPOSITORY
- METG/PRIVATE
- Approximate Boundary of Copper & Molybdenum Ore Body
- SAMPLE COLLECTED
- COLLAPSED ADIT WITH DISCHARGE
- COLLAPSED ADIT WITH WASTE ROCK
- COLLAPSED ADIT WITH WASTE ROCK AND DISCHARGE
- DISTURBED AREA
- DISTURBED AREA WITH DISCHARGE
- PHYSICAL HAZARD
- PHYSICAL HAZARD WITH WASTE ROCK
- SURFACE WATER/SEDIMENT
- MINE
- STREAM
- STREAM (EU 13)

N

DISPLAYED AS:
PROJECTION/ZONE: MSP
DATUM: NAD 83
UNITS: INTERNATIONAL FEET
SOURCE: PIONEER/SPECTRUM

0 500 1,000 2,000
Feet

FIGURE 25

PIONEER TECHNICAL SERVICES, INC.

UBMC PROPOSED PLAN
EA5 MINING-RELATED
FEATURE LOCATIONS
SOUTH OF BLACKFOOT RIVER

DATE: 10/8/2015

Path: K:\GIS\Project\Edited_10052015\UBMC_FS-GI-PLN-049-15_EditedTo_Fig25_10072015.mxd

TABLE 1A SITE-SPECIFIC CLEANUP LEVELS FOR SOIL
UBMC Proposed Plan
Upper Blackfoot Mine Complex, Lewis and Clark County, Montana

EU Media	COC	UBMC SSCLs (mg/kg)	Final SSCL Origin
Site-Wide Soil SSCLs (unless noted below for a specific EU)	Aluminum	31092.00	UBMC Background
	Arsenic	40.44	UBMC Background
	Cadmium	4.80	UBMC Background
	Copper	275.10	UBMC Background
	Iron	NR	Not a COC
	Lead	1109.00	UBMC Background
	Manganese	4893.00	UBMC Background
	Zinc	550.90	UBMC Background
EU 2	Iron	259173.00	GW SSCL
EU 4	Iron	58270.00	UBMC Background
EU 5	Iron	58270.00	UBMC Background
EU 7	Iron	762134.00	GW SSCL
EU 9A	Iron	675408.00	GW SSCL
EU 9B	Arsenic	167.00	GW SSCL
EU 9B	Copper	60844.00	GW SSCL
EU 9B	Iron	675408.00	GW SSCL
EU 10	Iron	58270.00	UBMC Background
EU 11	Iron	199000.00	GW SSCL

Notes:

mg/kg	milligrams per kilogram
COC	Contaminant of concern
EU	Exposure unit
SSCL	Site-specifc cleanup level
NR	No Risk

Tetra Tech, Inc. 2014

TABLE 1B SITE-SPECIFIC CLEANUP LEVELS FOR SEDIMENT

UBMC Proposed Plan

Upper Blackfoot Mine Complex, Lewis and Clark County, Montana

EU Media	COC	UBMC SSCLs (mg/kg)	Final SSCL Origin
EU 12 Upper Marsh Flood Plain Sediment	Aluminum	8030.00	UBMC Background
	Arsenic	32.30	UBMC Background
	Cadmium	3.53	Eco: Aquatic
	Copper	1240.00	UBMC Background
	Iron	14500.00	UBMC Background
	Lead	174.00	UBMC Background
	Manganese	696.00	UBMC Background
	Zinc	300.00	UBMC Background
EU 13 Streambed Sediment (Upper Marsh downstream to Hoagum Creek)	Aluminum	8980.00	UBMC Background
	Arsenic	17.00	Eco: Aquatic
	Cadmium	3.53	Eco: Aquatic
	Copper	197.00	Eco: Aquatic
	Iron	35800.00	No Risk
	Lead	91.00	Eco: Aquatic
	Manganese	578.00	UBMC Background
	Zinc	315.00	Eco: Aquatic

Notes:

mg/kg	milligrams per kilogram
COC	Contaminant of concern
EU	Exposure unit
SSCL	Site-specifc cleanup level

Tetra Tech, Inc. 2013b

Table 2 – Groundwater and Surface Water Cleanup Levels

Chemical	DEQ-7 Numeric Groundwater Quality Standard (mg/L)	DEQ-7 Numeric Surface Water Quality Standard (mg/L)
Aluminum*	20	20
Arsenic	0.01	0.01
Cadmium***	0.005	0.005
Copper***	1.3	1.3
Iron*	14	14
Lead***	0.015	0.015
Manganese**	0.94	0.43
Zinc***	2	2

Notes:

* The cleanup levels are site-specific calculations

** The groundwater cleanup level is derived from the background manganese concentrations, while the surface water cleanup level is a site-specific calculation.

*** Hardness dependent for surface water aquatic standards – hardness data will need to be collected at the time of sampling to demonstrate compliance with aquatic SSCLs.

mg/L milligrams per Liter

DEQ-7 Montana Numeric Water Quality Standards, October 2012

Table 3

SUMMARY OF PRE-1994 UBMC DATA COLLECTION EVENTS

Reference	Sampling Dates	Sampled Matrix
Boojum (1990)	October 1989	SLG
Corry (1991)	October 1991	SW
Decker-Hess (1978)	May, June, July, September 1977	SW
Delta (1987)	July, 1987	SW
Delta (1989)	July, August, October 1989	GW
Hydrometrics (1991a,b, 1992)	August, September, November 1991 April, May, June, August 1992	SW,SED
Ingman et al. (1990)	August 1988 April, May 1989	SW
Kerr (1986)	September 1984 May 1986	SW
Kerr (1990)	July 1990	SW
Kerr (1991)	March, April, May, June 1991	SW
MFG (1994)	1993	SW, SED, SOIL
MDHES (1994)	June 1993	SW, SED, SOIL
MDSL (1991)	June, November 1990	SW, SOIL
Montana State Board of Health (MSBOH) (1961, 1964a,b, 1966)	February 1961 July, November 1964 August 1966	SW
Moore (1990)	June, July 1988 July, August, September 1989	SW, SED
PTI Environmental Services (PTI) (1994)	1992-1993	SW, GW, SOIL

Reclamation Research Unit, Montana State University and MSI Detoxification Inc. (RRU and MSI, 1988)[1]	April, May, July 1987 January 1988	SW,GW,SED,VEG
Spence (1975a)	1975	SW
Spence (1975b)	1968-1975	SW

Notes:
[1] Also referred to as Dollhopf, D.J. et al. 1988
SW = surface water
GW = ground water
SED = stream sediment
SLG = sludge
VEG = vegetation

Table 4

SUMMARY OF 1994-2005 DATA COLLECTION EVENTS

Reference	Sampling Dates	Sampled Matrix
Asarco Consulting, Inc. (2004)[1]	2003	SW,GW,SED
Asarco Consulting, Inc. (2005)[1]	2004	SW,GW,SOIL
Asarco Consulting, Inc. (2006)[1]	2005	SW, GW
Furniss (1995)[2]	1994	SW,SED,GW
Hydrometrics (1995) [1]	1994	SW,GW,SOIL
Hydrometrics (1996) [1]	1995	SW,GW,SED,SOIL
Hydrometrics (1997) [1]	1996	SW,GW,SOIL
Hydrometrics (1998) [1]	1997	SW,GW,SOIL
Hydrometrics (2001) [1]	2000	SW,SOIL
Hydrometrics (2002) [1]	2001	SW,GW,SOIL
MBMG (1998)	June 1997	SW,SOIL
Menges (1997)	August, October 1995 January, February 1996	SW,SED
MSE (1997)	Grouting project	SW,GW
Nagorski et al. (2000)	August 1998	SW,SED
Vandeberg (2005)[3]	2002	SED, SOIL

Notes:
SW = surface water
GW = ground water
SED = stream sediment
SOIL = soil and/or mine waste
[1]Denotes annual monitoring data collected by ASARCO and ARCO.
[2] The Furniss (1995) investigation included collection of iron oxides from Paymaster Creek sediments.
[3]Vandeberg (2005) collected floodplain sediment samples at locations similar to the sites sampled by Moore (1990) and/or Nagorski et al. (2000) for streambed sediments.

Table 5

WTP Confirmation Sampling for Sub-Surface Soil (mg/kg)								
Metals	**Al**	**As**	**Cd**	**Cu**	**Fe**	**Pb**	**Mn**	**Zn**
***Protection to Groundwater SSCLs (EU2)**	**31,100**	**177**	**14**	**5,300**	**259,000**	**1,100**	**4,890**	**2,950**
#Construction Worker	**NR**	**NR**	**NR**	**NR**	**NR**	**430**	**NR**	**NR**
Sample #	**East Pile – 1994/95 Confirmation Sampling**							
9509-200	3,280	120	1	130	24,500	100	180	55
9509-201	3,270	86	2	120	23,500	190	230	250
9509-202	3,480	81	<1	110	20,200	110	610	70
9509-203	6,020	27	<1	120	11,400	76	830	87
9509-204	4,630	17	<1	120	12,600	46	940	98
Sample #	**West Pile – 2008 Cell 6 Confirmation Sampling during WTP Construction**							
North	14,000	80	5.7	310	51,000	310	790	340
Northeast	10,000	42	6.5	120	25,000	330	1,300	570
TP1	10,300	17.5	0.6	85.6	30,800	103	275	241
TP2-PostEx	9,240	*295	0.55	240	36,200	296	708	296
TP3	9,660	111	1.31	120	30,200	69.9	672	162
Sample #	**Cell 5 – (between East & West piles) Confirmation Sampling during 2011 Cell 5 Reconstruction**							
AHD-1109-111	7,510	26	1.4	192	81,500	85	754	884
AHD-1109-112	9,610	21	4.3	207	117,000	99	1,010	1,210
AHD-1109-113	9,470	27	2.7	267	70,200	82	1,700	1,480
AHD-1109-114	10,000	32	0.2	206	98,500	113	389	510
AHD-1109-115	8,880	26	0.3	360	85,500	113	367	616
AHD-1109-116	9,960	37	<0.2	340	85,500	133	335	616
AHD-1109-117	9,740	19	<0.2	213	68,800	97	222	704
AHD-1109-118	10,700	38	4.1	320	67,000	333	1,130	757
AHD-1109-119	10,600	36	2.8	403	56,200	200	950	879
AHD-1109-120	12,500	48	6.5	465	61,800	369	1,930	1,120
AHD-1109-121	10,700	45	5.7	359	49,500	371	2,020	1,560
AHD-1109-130	9,150	29	1.8	129	23,600	163	594	411
AHD-1109-131	7,830	20	1.2	183	24,300	176	858	294
AHD-1109-132	8,380	17	5.2	187	22,300	197	649	355
AHD-1109-133	8,380	17	1.6	148	26,100	229	765	366
AHD-1109-134	8,540	39	3.1	181	27,700	338	1,290	563

EU – Exposure Unit The RI divided the UBMC into 13 EUs to either assess the effectiveness of previous interim actions or delineate the lateral extent of floodplain contamination in Mike Horse Creek, Beartrap Creek, and the Blackfoot River.

* The protection to groundwater site-specific cleanup levels (SSCLs) are specific to EU2. If a sample has a collocated synthetic precipitation leaching procedure (SPLP; simulates rainfall and ability for metals to leach into the soil and/or groundwater) analysis and has an exceedance of a site-wide SSCL, that sample's SPLP result can be used to calculate the protection to groundwater SSCL that is specific to that location. Sample location TP2-Post Ex had a site-wide exceedance for arsenic, but it didn't exceed that location specific screening level of 340 mg/kg.

Construction worker for subsurface soils (> 2 feet) only – clean fill imported for surface soils around the old WWTS.

Table 6 - Stevens Gulch Sediment

Stevens Gulch Sediments								
Metals	**Al**	**As**	**Cd**	**Cu**	**Fe**	**Pb**	**Mn**	**Zn**
SSCL Source	**NA**	**Eco/Aquatic**	**Eco/Aquatic**	**Eco/Aquatic**	**NA**	**Eco/Aquatic**	**Bkgrd**	**Eco/Aquatic**
Sediment SSCLs mg/kg	**NR**	**17**	**3.53**	**197**	**NR**	**91**	**578**	**315**
Above/Below Capital Mine to end of Trust Property								
SGSE-101	NS	NS	NS	NS	NS	NS	NS	NS
Capitol Mine RI Soil Data (highest values)**	2850	1570	3.04	361	194000	2140	178	628
Capitol Mine RI Soil Data (highest values)**	11100	354	2.98	462	51600	2270	712	1230
SGSE-102	3740	324	11	500	147000	2300	436	2170
SGSE-103	4450	300	10.9	588	159000	1220	370	2320
Below Trust Property/Above old Paymaster Road on Forest Property								
SGSE-105	5000	196	4.12	375	91400	1070	481	895
SGSE-106	5870	145	1.29	336	58000	674	383	369
SGSE-107	6460	168	1.84	341	73400	694	259	415
BRSW-108	No Analysis	59.2	0.6	283	No Analysis	395	336	194

Exceeds Aquatic SSCLs

NA - Not Applicable

NR - No Risk

Table 7 - Stevens Gulch Surface Water

Upper Stevens Gulch near Capital Mine								
Metals & Other Pertinent Data	**[b]Al**	**As**	**[a]Cd**	**[a]Cu**	**Fe**	**[a]Pb**	**Mn**	**[a]Zn**
DEQ-7 Human Health mg/L	***20**	**0.01**	**0.005**	**1.3**	***14**	**0.015**	***0.43**	**2**
DEQ-7 Aquatic (Chronic)	**0.087**	**0.15**	**0.00023**	**0.0076**	**1**	**0.0024**	****NS**	**0.098**
DEQ-7 Aquatic (Acute)	**0.75**	**0.34**	**0.0017**	**0.011**	****NS**	**0.061**	****NS**	**0.098**
SGSW-5 (1995-97) Above Capital Mine - Pre-removal	<0.05 - 0.091	<0.002 - 0.012	<0.001	0.009 - 0.16	<0.03 - 0.17	<0.003	<0.01 - 0.042	0.021 - 0.07
SGSW-5 (1998) Above Capital Mine - First Year Post Removal	<0.05	<0.002	<0.001	0.016 - 0.054	<0.03 - 0.49	<0.003 - 0.005	0.032 - 0.036	0.042 - 0.043
SGSW-5 (2001) Above Capital Mine - Post Removal	<0.05	<0.005	<0.0002 - 0.0003	0.011 - 0.027	<0.05 - 0.031	<0.003	<0.01 - 0.025	0.031 - 0.044
SGSW-101 (2008) Similar location to SGSW-5	<0.03	<0.003	0.00018	0.086	0.11	0.0065	0.024	0.03
SGSW-7 (1995-97) Below Capital Mine - Pre-removal	<0.05 - 0.11	<0.002 - 0.021	<0.001 - 0.001	0.024 - 0.065	0.84 - 4.9	0.008 - 0.12	0.064 - 0.4	0.074 - 0.19
SGSW-7 (1998) Below Capital Mine - First Year Post Removal	<0.05 - 0.1	<0.002 - 0.11	<0.001 - 0.001	0.007 - 0.14	0.42 - 16.0	0.008 - 0.69	0.1 - 0.35	0.059 - 0.55
SGSW-7 (2001) Below Capital Mine - Post Removal	<0.05	<0.005	<0.0002 - 0.0002	0.002 - 0.011	0.31 - 0.76	0.003 - 0.022	0.033 - 0.076	0.036 - 0.046
SGSW-102 (2008) Similar location to SGSW-7	<0.03	<0.003	<0.00008	0.004	<0.05	0.002	0.007	0.01
SGSW-103 (2008)	0.03	<0.003	0.00047	0.011	<0.05	0.0009	0.024	0.1
SGSW-105 (2008)		<0.003	0.00032	0.015	0.1	0.0028	0.02	0.06
SGSW-106 (2008)		<0.003	0.00053	0.054	0.06	0.0022	0.18	0.12
SGSW-107 (2008)		<0.003	0.00076	0.076	0.14	0.0025	0.299	0.17
Lower Stevens Gulch near Tunnel #3 and the confluence with the Blackfoot River								
Metals & Other Pertinent Data	**[b]Al**	**As**	**[a]Cd**	**[a]Cu**	**Fe**	**[a]Pb**	**Mn**	**[a]Zn**
DEQ-7 Human Health mg/L	***20**	**0.01**	**0.005**	**1.3**	***14**	**0.015**	***0.43**	**2**
DEQ-7 Aquatic (Chronic)	**0.087**	**0.15**	**0.00012**	**0.0038**	**1**	**0.00084**	****NS**	**0.049**
DEQ-7 Aquatic (Acute)	**0.75**	**0.34**	**0.00073**	**0.0052**	****NS**	**0.0022**	****NS**	**0.049**
BRSW-8 (1995-97) Upstream of old Paymaster Road and Tunnel #3 - Pre-removal	0.33 - 2.1 (pH N/A)	<0.002 - <0.008	<0.001 - 0.002	0.083 - 0.31	<0.05 - 0.84	<0.003 - 0.015	0.21 - 0.6	0.14 - 0.33
BRSW-8 (1998) Upstream of old Paymaster Road and Tunnel #3 - First Year Post Removal	1.4 - 1.5 (pH N/A)	<0.002	0.001	0.14 - 0.18	0.19	<0.003 - 0.007	0.47 - 0.53	0.27 - 0.29
BRSW-8 (2001) Upstream of old Paymaster Road and Tunnel #3 - Post Removal	0.6 - 1.2 (pH N/A)	<0.005	0.001 - 0.0011	0.092 - 0.16	<0.02 - 0.11	0.004 - 0.006	0.26 - 0.44	0.19 - 0.28
BRSW-108 (2008) Similar location to BRSW-8	<0.03	<0.003	0.00042	0.055	0.23	0.001	0.137	0.1
BRSW-26 (1995-97) Above confluence with Blackfoot River - Pre-removal	<0.05 - 0.87 (pH N/A)	<0.002	<0.001 - 0.001	0.085 - 0.13	0.72 - 0.84	0.008 - 0.016	0.2 - 0.37	0.17 - 0.26
BRSW-26 (1998) Above confluence with Blackfoot River - First Year Post Removal	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
BRSW-26 (2001) Above confluence with Blackfoot River - Post Removal	0.59	<0.005	0.0009	0.094	0.15	0.006	0.26	0.19

	Exceeds Human Health and Aquatic for Fe & Pb; Human Health only for As & Mn
	Exceeds Aquatic only

a Freshwater Aquatic Life Standards for these metals are expressed as a function of total hardness (mg/L, $CaCO^3$, DEQ-7, October 2012

b Applies only to surface water that has a pH between 6.5 and 9.0.

* The cleanup levels are site-specific (EPA 2014) calculations.

**NS Currently in DEQ-7, there is neither an acute aquatic standard for iron nor chronic or acute aquatic standards for manganese. Aluminum does not have a human health standard.

mg/L milligrams per Liter

Table 8

Swamp Gulch Surface Water Quality								
BRSW-14 Metals Concentrations Range Pre/Post Cleanup (mg/L)								
Metals	**Al**	**As**	**Cd[a]**	**Cu[a]**	**Fe**	**Pb[a]**	**Mn**	**Zn[a]**
DEQ-7 Human Health	****NS**	**0.01**	**0.005**	**1.3**	***14**	**0.015**	***0.43**	**2**
DEQ-7 Aquatic[b] (Chronic)	**[t]0.087**	**0.15**	**0.00018**	**0.0059**	**1**	**0.0016**	****NS**	**0.076**
DEQ-7 Aquatic[b] (Acute)	**[t]0.75**	**0.34**	**0.0012**	**0.0084**	****NS**	**0.041**	****NS**	**0.076**
BRSW-14 Background (1991-96)	**0.27**	**0.01**	**0.005**	**0.15**	**3.155**	**0.028**	**0.509**	**0.584**
BRSW-15 Metals Concentrations Range Pre Cleanup (mg/L)								
BRSW-15 Pre (1991-94)	<0.05-0.16	<0.003-<0.02[c]	0.001 - 0.042	0.16 - 1.35	8.85 - 64.7	<0.005 - 0.18	0.96 - 6.8	0.145 - 3.73
BRSW-15 Metals Concentrations Range Post Cleanup (mg/L)								
BRSW-15 Post (1995-98)	<0.05	<0.002 - 0.002	<0.001-<0.001	<0.005 - 0.01	0.11 - 1.3	<0.003 - 0.005	0.06 - 0.33	0.01 - 0.065

Exceeds site-specific background

a Freshwater Aquatic Life Standards for these metals are expressed as a function of total hardness (mg/L, $CaCO^3$; DEQ-7, October 2012)

b BRSW-14 total hardness as $CaCO^3$ is 58 mg/L and is based on total hardness results averaged over 15 sampling events.

c Detection limit for arsenic is higher than the DEQ-7 Human Health surface water standard and background. However, all of the other samples were non-detect at a detection limit less than the standard.

* The cleanup levels are site-specific (EPA 2014) calculations.

**NS Currently in DEQ-7, there is neither an acute aquatic standard for iron nor chronic or acute aquatic standards for manganese. Aluminum does not have a human health standard.

t Applies only to surface water that has a pH between 6.5 and 9.0.

mg/L milligrams per Liter

Table 9

Paymaster Creek Surface Water Quality							
Metals	**As**	**Cd[a]**	**Cu[a]**	**Fe**	**Pb[a]**	**Mn**	**Zn[a]**
DEQ-7 Human Health	**0.01**	**0.005**	**1.3**	**14***	**0.015**	**0.43***	**2**
DEQ-7 Aquatic[b] (Chronic)	**0.15**	**0.0001**	**0.0029**	**1**	**0.00054**	**NS**	**0.037**
DEQ-7 Aquatic[b] (Acute)	**0.34**	**0.00052**	**0.0038**	**NS**	**0.014**	**NS**	**0.037**
PCSW-4 & 5 (1994-97 – 3 samples taken) Metals Concentrations Range – Reference Above Mike Horse Fault	<0.002-<0.005	<0.001-<0.001[c]	<0.005-<0.01[c]	<0.03-0.1	<0.003-<0.01[c]	<0.01-0.02	<0.01-0.04
PCSW-1 & 3 (1994-97 – 6 samples taken) Metals Concentrations Range – Reference Below Mike Horse Fault and Above Paymaster Area Mining Claims	<0.002-<0.005	<0.001-<0.001[c]	<0.005-<0.01[c]	0.3-2.4	<0.003-<0.01[c]	0.014-0.32	0.024-0.11
BRSW-21 (1993-99/2007 – 19 samples taken) Metals Concentrations Range – Upstream End of Paymaster Area Mining Claims/Above Known Mining Activities	<0.002-0.007	<0.0001 - <0.001[c]	0.007-0.079	0.6-6.1	<0.0005-0.096[d]	0.041-0.36	0.02-0.1
BRSW-13 (1991-2000/2007 – 31 samples taken) Metals Concentrations Range – Downstream End of Paymaster Area Mining Claims/Below Known Mining Activities	<0.002 - <0.02[e]	<0.0001 - <0.008[f]	0.025-0.2	0.5-6.7	<0.002-0.01	0.039-0.42	0.02-0.11

Exceeds DEQ-7 Surface Water Standard for Human Health and Aquatic Life.

Exceeds DEQ-7 Surface Water Standards for Aquatic Life

a Freshwater Aquatic Life Standards for these metals are expressed as a function of total hardness (mg/L, $CaCO^3$; DEQ-7, October 2012)

b Total hardness as $CaCO^3$ is 25 mg/L for all of the sampling stations. The total hardness is an average based on total hardness results divided by sampling events for each sampling station.

c Detection limit is higher than the DEQ-7 human health and/or aquatic surface water standard.

d This human health exceedance (0.096 mg/L) for lead appears to be an anomaly and the location is upstream of the historical mining area. It is the only exceedance of the 19 samples and the other samples were right at or near the detection limits that ranged between <0.0005 - <0.01. In addition, the dissolved portion of the sample was <0.003 mg/L for lead.

e All arsenic samples for this station were below detection limits. Only 3 of the 31 samples had the high (<0.02 mg/L; sampled in 1991) detection limit, while the other samples detection limits ranged from <0.002 - <0.008 mg/L.

f All but 3 cadmium samples for this station were below the human health standard. The 3 exceedances were samples that had non-detects with a high (<0.008 mg/L; sampled in 1991) detection limit, while the other 28 samples detection limits ranged from <0.0001 - <0.005 mg/L.

* The cleanup levels are site-specific calculations.

** Currently, in DEQ-7 there is neither an acute aquatic standard for iron nor chronic or acute aquatic standards for manganese.

NS **No Standard or SSCL.**

Table 10 Preliminary Site Conceptual Exposure Model

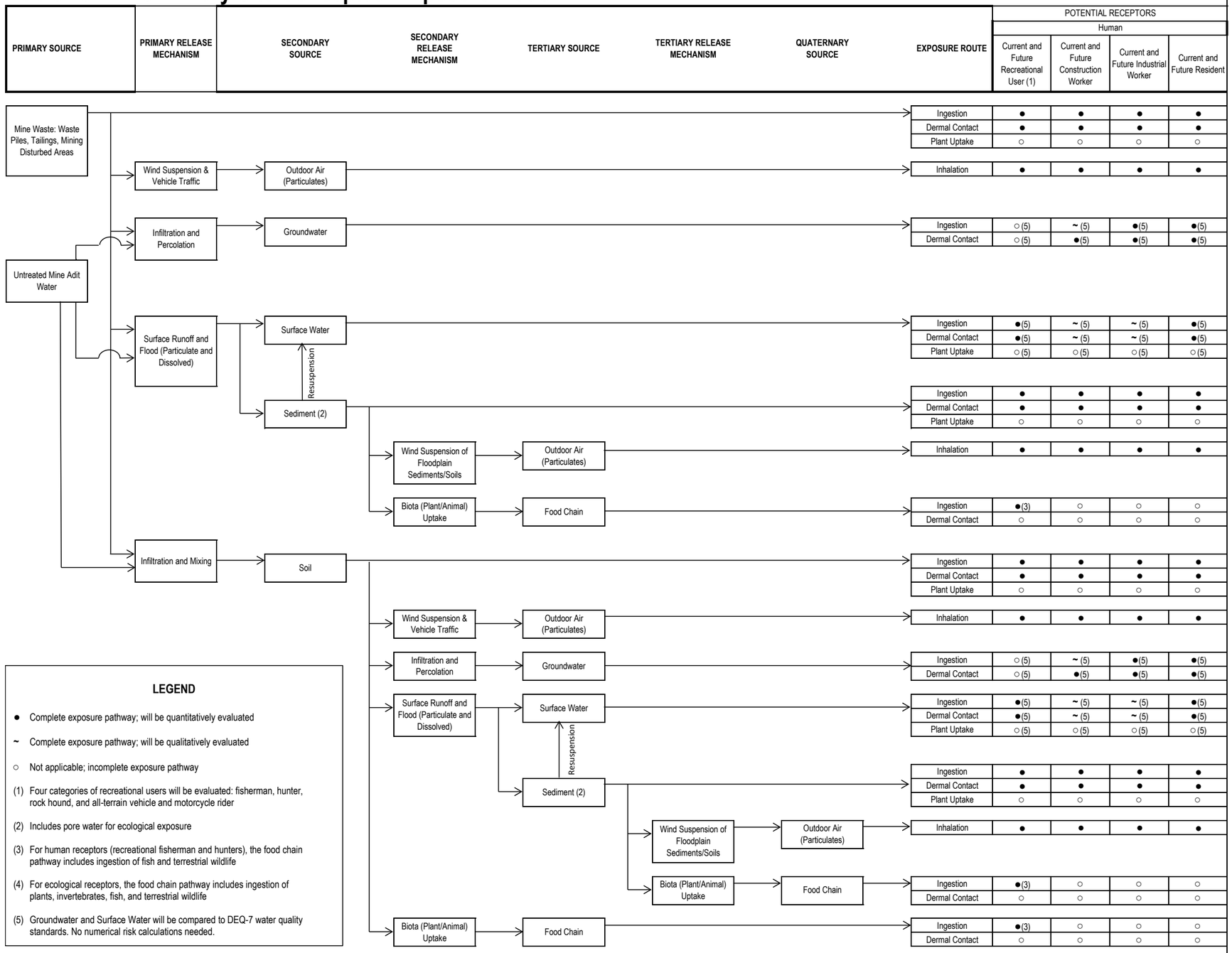
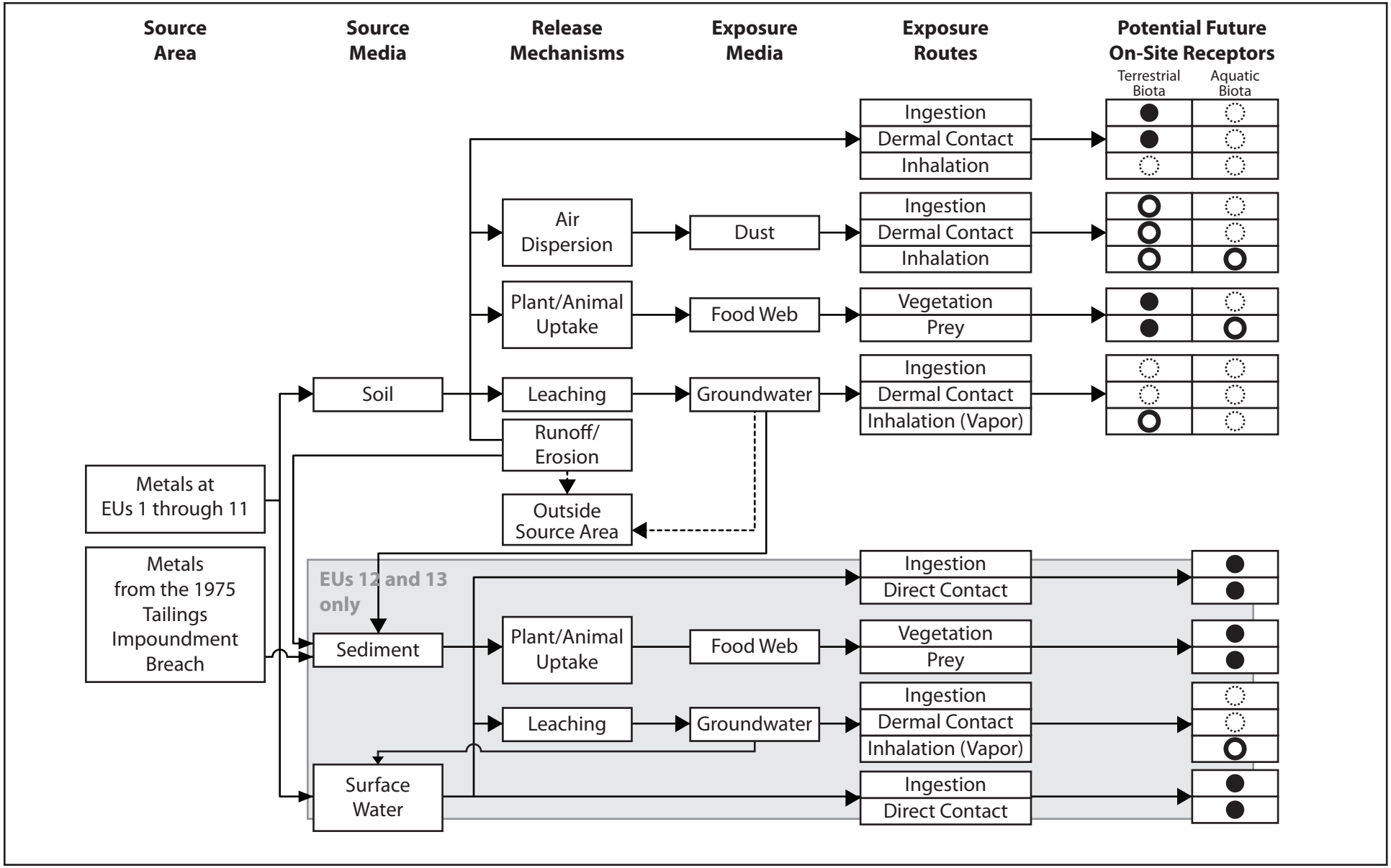


Figure 4-1
Preliminary Conceptual Site Exposure Model
Upper Blackfoot Mining Complex



Notes:

- ● Complete Pathway; quantitatively evaluated
- ○ Potentially Complete Pathway; not evaluated
- ◌ Incomplete Pathway; not evaluated

Table 11

Conceptual Site Model of Exposure Routes and Potential Ecological Receptors

Proposed Plan
Upper Blackfoot Mining Complex

Table 12-1 Feasibility Study Alternatives for EA 1 - Upland Waste Areas

EVALUATION AREA EA 1 Upland Waste Areas	REMEDIAL ALTERNATIVE								COMMENTS
		PHYSICAL HAZARDS/SOLID MEDIA							
		ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT			
						In-situ	Ex-situ		
	No Action	Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Blending and Co-Disposal	Neutralization W/Alkaline Amendment	
Upper Anaconda Mine (EU 1A) Waste Areas	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Anaconda adit water is addressed in EA 2. Waste removal areas previously reclaimed using lime and cover. Steep, rocky terrain makes access difficult. No apparent impacts to GW or SW.
Upper Anaconda Mine (EU 1B) Waste Piles	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Anaconda adit water is addressed in EA 2. Waste removal areas previously reclaimed using lime and cover. Steep, rocky terrain makes access difficult. In-situ treatment will be difficult due to rocky soil. No apparent impacts to GW or SW.
Capital Mine (EU 3) Waste Area	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Site is bisected by Stevens Creek. Waste removal areas previously reclaimed using lime and cover. No apparent impact to SW at downgradient SGSW-102. Coarse rock and steep terrain will make in-situ treatment difficult. Access very difficult on narrow, windy road.
Carbonate Mine (EU 4) Waste Area	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Groundwater issues are addressed in EA 2. Waste removal areas previously reclaimed using lime and cover. Located in the Swamp Gulch drainage adjacent to Hwy 200. Removal will likely require stream diversion and dewatering.
Edith Mine (EU 5) Waste Area	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Waste removal areas previously reclaimed using lime and cover. Relatively easy access to this site. No apparent impacts to GW or SW associated with these removal areas.
Consolation Mine (EU 6) Waste Area	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Waste removal areas previously reclaimed using lime and cover. Relatively easy access to the site, but the removal area is on a partially timbered slope. Rocky surface soils would make in-situ treatment difficult.
Mary P Mine (EU 7) Waste Pile	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Site located adjacent to Blackfoot River floodplain wastes, with easy access. Relatively small volume of waste; would require regrading for in-situ treatment. Potential susceptibility to erosion from high water if left in place.
Mike Horse Mine (EU 8) Waste Area	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Mike Horse adit and seep water, and Mike Horse bedrock GW are addressed in EA 2. Waste removal areas previously reclaimed using lime and cover. Previous removals left bare rock and in some areas ore-body exposed, making in-situ treatment difficult. Steep slopes in areas will make containment difficult.
Paymaster Mine (EU 9A) Waste Area -Surface	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Paymaster Gulch GW is addressed in EA 2. SW has metals exceedances both upstream and downstream of known mine disturbances. Waste removal areas previously reclaimed using lime and cover. Relatively easy access to site.
Paymaster Mine (EU 9B) Waste Area -Subsurface	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Paymaster Gulch GW is addressed in EA 2. SW has metals exceedances both upstream and downstream of known mine disturbances. Relatively easy access to site. Impacted soils are below the surface, requiring uncovering or removal for in-situ treatment.
No. 3 Tunnel Mine (EU 10) Waste Area	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Waste removal areas previously reclaimed using lime and cover. Relatively easy access to the site. Vegetative cover at the site is good. Area of exceedance is relatively small.

GW: Groundwater. SW: Surface Water.

Table 12-2 Feasibility Study Alternatives for EA 2 - Groundwater

EVALUATION AREA	REMEDIAL ALTERNATIVE									COMMENTS
		GROUNDWATER								
			ENGINEERING CONTROLS				TREATMENT			
							Active		Passive	
EA 2 Groundwater	No Action	Monitored Natural Attenuation	Containment (Retention)	Detention	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent	
Anaconda Mine (EU 1) Adit Discharge	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Mine waste areas addressed in EA 1. Adit discharge currently routed to and treated at the WTP. Site constraints (access, steep terrain) may preclude passive treatment.
Carbonate Mine (EU 4) Groundwater	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Mine waste areas addressed in EA 1. Capturing and conveying the GW to the WTP (Active Treatment) would require constructing a new capture and conveyance system, constructing a pump station, and expanding the WTP. SW/GW diversion (Hydraulic control) could reduce the quantity of impacted GW.
Mike Horse Mine (EU 8) Adit Discharge and Seeps	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Mine waste areas addressed in EA 1. GW collection system currently conveys this water to the existing WTP for treatment. Construction of passive treatment may be difficult due to the complexity of the site and the chemistry of the water.
Paymaster Gulch Groundwater Aquifers	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Unknown quantity of water. Capturing all of the impacted water will be difficult. Conveying to WTP would require new capture and conveyance system, constructing a pump station, and expansion of the WTP.
Upper Mike Horse Mine Bedrock Groundwater Aquifer	Yes	Yes	No	No	No	No	Yes	Yes	No	Unknown quantity of water. Capturing all of the impacted water will be difficult. Conveying to WTP would require new system and expansion of the WTP. Use of passive treatment (PRB) is not applicable for this bedrock aquifer with complex underground workings and the chemistry of the water.
Capital Mine Adit Plug	Yes	No	No	No	No	Yes	No	No	No	Leaking mine adit was closed with a grout seal and backfilled as part of a 1997 interim action. No mention of plugged adit site condition in the RI field notes.

GW: Groundwater. SW: Surface Water.

Table 12-3 Feasibility Study Alternatives for EA 3 - Surface Water and Sediment

EVALUATION AREA EA 3 Surface Water and Sediment	REMEDIAL ALTERNATIVE															
	No Action	PHYSICAL HAZARDS/SOLID MEDIA								SURFACE WATER						
		Monitored Natural Recovery	ENGINEERING CONTROLS/ LAND DISPOSAL				TREATMENT			ENGINEERING CONTROLS				TREATMENT		
							In-situ	Ex-situ						Active		Passive
			Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization w/Alkaline Amendment	Blending and Co-Disposal	Neutralization w/Alkaline Amendment	Containment (Retention)	Detention	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Blackfoot River (EU 13) [1]	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Comments	Several variables make water treatment problematic including: quantity of water, variable flow rate, and variable water quality. Removal and disposal alternatives refer to stream sediments. Removal of sediment will require stream channel reconstruction, multiple temporary stream diversions and dewatering systems. Anticipate that both water quality and sediment COC levels will improve with time, following the upstream floodplain sediment removals conducted within the EE/CA area.															
Stevens Creek	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Comments	Several variables make water treatment problematic including: quantity of water, variable flow rate, and variable water quality. Removal and disposal alternatives refer to stream sediments. Removal of sediment will require stream channel reconstruction, multiple temporary stream diversions, dewatering systems, and extensive road building in steep, timbered terrain and mineralized rock. Multiple sources along Stevens Creek contribute to water quality exceedances. Waste source removals are addressed in EA 1 and EA 5.															
Other Streams																
Porcupine Creek	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Comments	Surface water samples in Porcupine Creek (PBBS-200, PBBS-202) showed no exceedances; however, the corresponding sediment samples showed exceedances. Therefore only solid media alternatives are applicable. Remediation volume estimates and costs are included with mining-related feature PBBS.															
Paymaster Creek	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Comments	Surface water quality at the downstream end of Paymaster Gulch (BRSW-13) exceeded DEQ-7 aquatic life standards. Paymaster Creek flows through a highly mineralized zone with ferricrete deposits and other evidence off natural high metals concentrations. Several variables make water treatment problematic including: quantity of water, variable flow rate, and variable water quality. The BRSW-13 sediment sample showed exceedances. Removal and disposal alternatives refer to stream sediments. Removal of sediments will require stream channel reconstruction, multiple temporary stream diversions and dewatering systems.															
Shave Creek	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Comments	Several variables make water treatment problematic including: quantity of water, variable flow rate, and variable water quality. A sediment sample showed exceedances. Removal and disposal alternatives refer to stream sediments. Removal of sediments will require stream channel reconstruction, multiple temporary stream diversions and dewatering systems.															
Unnamed Tributary above WTP	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Comments	Surface water exceedances (Chronic: Cd, Zn; Acute: Zn) in one sample of this intermittent drainage – possibly runoff or seep. No sediment data.															

EVALUATION AREA EA 3 Surface Water and Sediment	REMEDIAL ALTERNATIVE															
	No Action	PHYSICAL HAZARDS/SOLID MEDIA								SURFACE WATER						
		Monitored Natural Recovery	ENGINEERING CONTROLS/ LAND DISPOSAL				TREATMENT			ENGINEERING CONTROLS				TREATMENT		
							In-situ	Ex-situ						Active		Passive
			Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization w/Alkaline Amendment	Blending and Co-Disposal	Neutralization w/Alkaline Amendment	Containment (Retention)	Detention	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Mining-related Feature Discharge, Seep or Spring																
Mine Feature BR-01 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Intermittent spring (150 square feet) at the toe of slope. No flow or water quality data.															
Mine Feature BR-14 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Collapsed adit with leaking water that is pooled near entrance supporting vegetation. No flow or water quality data.															
Mine Feature PBBS Discharge, seep, or spring	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Comments	Seep from collapsed adit. Surface water exceeds HH: Cd, Pb, Mn, Zn; Chronic: Cd, Cu, Fe, Pb, Zn; Acute: Cd, Cu, Pb, Zn. No flow data. Sediment exceeds for As, Cd, Pb, Mn, Zn.															
Mine Feature PC-11 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Seep from collapsed adit. Surface water exceeds Chronic: Cd, Zn; Acute: Zn.															
Mine Feature PC-22 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	PC-22 was identified as PC-21 in the RI but is a separate feature and includes a collapsed adit with a marshy area at the entrance, indicating adit discharge. No waste rock piles observed. No flowing water was observed and no water quality data were collected.															
Mine Feature SH-43 Discharge, seep, or spring	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Comments	Collapsed and leaking adit (2 to 5 gpm estimate) with additional flow contributed by seeps between adit and mined rock pile. Surface water (SHSW-103) exceeds HH: Mn; Chronic: As, Cd, Cu, Fe, Pb, Zn; Acute: Cd, Cu, Pb, Zn. Sediment exceeds for As, Cd, Pb, Mn, Zn.															
Mine Feature SG-55 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Pipe (4 inch) protruding from toe of cut-slope leaking small amounts of water. Surface water exceeds HH: As, Mn; Chronic: Fe; Acute: No exceedances. No flow rate measured.															

EVALUATION AREA EA 3 Surface Water and Sediment	REMEDIAL ALTERNATIVE															
	No Action	PHYSICAL HAZARDS/SOLID MEDIA								SURFACE WATER						
		Monitored Natural Recovery	ENGINEERING CONTROLS/ LAND DISPOSAL				TREATMENT			ENGINEERING CONTROLS				TREATMENT		
							In-situ	Ex-situ						Active		Passive
			Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization w/Alkaline Amendment	Blending and Co-Disposal	Neutralization w/Alkaline Amendment	Containment (Retention)	Detention	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Mine Feature SG-71 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Spring at possible adit location 70 feet from creek. Water has pooled and is 6 inches deep. No flow or water quality data.															
Mine Feature SG-94 Discharge, seep, or spring	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No
Comments	Iron precipitate, cone-forming spring. Flow estimated at 2 to 5 gpm. Surface water (SGSW-104) exceeds HH: As, Fe; Chronic: Fe, Zn; Acute: Zn. Sediment exceeds for As.															
Mine Feature SG-98 Discharge, seep, or spring	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Adit apparently had flow at some point as evidenced by strong iron oxide staining but was dry at the time of the field investigation in 2008. No flow or water quality data.															
Historic Paymaster Adit Discharge	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No
Comments	Adit was plugged and a discharge collection system and wetland treatment system were installed in 1996-1997 with the intent to discharge water into the upper wetlands cell. Water is currently seeping out of the slope toe on to the road next to the plugged adit. Wetland cells solid media addressed as Paymaster Mine Waste Areas in EA 1.															

[1]From the Upper Marsh to Hogum Creek.

Acute: DEQ-7 Acute Aquatic Standard and Chronic: DEQ-7 Chronic Aquatic Standard.

Table 12-4 Feasibility Study Alternatives for EA 4 - Upper Marsh

EVALUATION AREA EA 4 Upper Marsh	REMEDIAL ALTERNATIVE																
	No Action	PHYSICAL HAZARDS/SOLID MEDIA								GROUNDWATER/SURFACE WATER							
		Monitored Natural Recovery	ENGINEERING CONTROLS/ LAND DISPOSAL				TREATMENT			Monitored Natural Attenuation (Groundwater only)	ENGINEERING CONTROLS				TREATMENT		
			Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	In-situ	Ex-situ			Containment (Retention)	Detention	Hydrologic and Hydraulic Control	Inundation	Active		Passive
							Neutralization w/Alkaline Amendment	Blending and Co-Disposal	Neutralization w/Alkaline Amendment						Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Upper Marsh (EU 12) Eastern Area	Yes	Yes	No	Yes	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No	No
Comments:	Containment of marsh sediments may require special permitting for fill within jurisdictional wetlands and the floodplain and would require extensive design engineered measures to control flood flows and prevent erosion from flood events. Removal of marsh sediments will require stream channel reconstruction, wetland reconstruction, extensive temporary stream diversions, dewatering systems, and haul road network construction. The eastern area generally contains higher concentrations of As, Cd, Cu, Pb, and Zn in the upper 12 inches than in the western area of the Upper Marsh, with some exceptions downstream of the Carbonate Mine site. The Upper Marsh contains sensitive areas including two large fens and one large emergent forested wetland, considered as special aquatic sites by the Army Corps of Engineers that should be protected from impacts associated with remedial activities.																
Upper Marsh (EU 12) Western Area	Yes	Yes	No	Yes	Yes	Yes	No	No	No	Yes	No	No	No	No	No	No	No
Comments:	Containment of marsh sediments may require special permitting for fill within jurisdictional wetlands and the floodplain and would require extensive design engineered measures to control flood flows and prevent erosion from flood events. Removal of marsh sediments will require stream channel reconstruction, wetland reconstruction, extensive temporary stream diversions, dewatering systems, and haul road network construction. The western area generally contains lower concentrations of As, Cd, Cu, Pb, and Zn in the upper 12 inches than in the eastern area of the Upper Marsh, with some exceptions downstream of the Carbonate Mine site. The Upper Marsh contains sensitive areas including two large fens and one large emergent forested wetland, considered as special aquatic sites by the Army Corps of Engineers that should be protected from impacts associated with remedial activities.																

Table 12-5 Feasibility Study Alternatives for EA 5 - Mining-related Features

EVALUATION AREA EA 5 Mining-related Features[4]	REMEDIAL ALTERNATIVE								COMMENTS
		PHYSICAL HAZARDS/SOLID MEDIA							
		ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT			
						In-situ	Ex-situ		
	No Action	Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Blending and Co-Disposal	Neutralization W/Alkaline Amendment	
Anaconda Creek Drainage									
AC-01	Yes	No	Yes	Yes	Yes	Yes	No	No	Mine waste is incorporated into road fill slope, the toe of slope contacts Anaconda Creek. Access to this site will be moderately difficult.
Blackfoot River Drainage									
BR-01, BR-14, BR-16 BR-20, BR-32, BR-39	Yes	No	Yes	Yes	Yes	Yes	No	No	BR-39 is a caved adit and waste pile along edge of unnamed creek. BR-01 and BR-14 are collapsed adits with seeps. Access to BR-01, adjacent to the Blackfoot River, is relatively easy, but access to the other sites will be difficult on the steep, timbered slope. Seepage water and unnamed creek water quality are addressed in EA 3.
BR-29	Yes	No	Yes	Yes	Yes	Yes	No	No	Located approximately 350 feet uphill from Mary P Mine in heavy timber on steep slopes. There are no roads to this feature; access difficult.
Pass Creek Drainage									
PC-01, PC-06, PC-11, PC-21, PC-22	Yes	Yes	Yes	Yes	Yes	Yes	No	No	PC-01 includes an open timber shaft with water which creates a physical hazard requiring a physical barrier. Water quality (PCSW-102) meets DEQ-7 GW Standards. PC-11 is a collapsed adit with a seep. Water from PC-11 is addressed in EA 3. PC-21 is an open adit requiring a physical barrier. PC-06 is a collapsed adit with waste rock. Water from PC-22 is address in EA 3.
Porcupine Gulch Drainage									
PBBS	Yes	No	No	No	No	No	No	No	Site includes collapsed adit with a discharge, waste rock pile in close proximity to Porcupine Creek. No exceedances in the sampled waste. Access is moderately difficult on unmaintained road. Water from the adit is addressed in EA 3.
Paymaster Gulch Drainage									
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	Yes	No	Yes	Yes	Yes	Yes	No	No	Access to each of these sites will be moderately difficult as there are no maintained roads and the features are located on heavily timbered slopes on either side of Paymaster Creek.
PM-26, PM-28	Yes	No	Yes	Yes	Yes	Yes	No	No	PM-26 is located high up in the drainage and PM-28 is located at the very top of the drainage – access will be difficult for both.
Shave Gulch Drainage									
SH-17, SH-23, SH-29, SH-37 SH-43, SH-44	Yes	No	Yes	Yes	Yes	Yes	No	No	Features SH-17 and SH-23 are located on the west side of Shave Gulch Road, near Shave Creek. SH-29, 37, 43, and 44 are located on the east side of Shave Gulch, uphill from the creek. SH-43 is a collapsed and leaking adit. Water from SH-43 is addressed in EA 3.
SH-06, SH-07, SH-13, SH-14	Yes	Yes	Yes	Yes	Yes	Yes	No	No	These features are located on the east side of Midnight Hill, with poor or no road access. SH-06 is an open adit with waste rock requiring a physical barrier.

EVALUATION AREA EA 5 Mining-related Features[4]	REMEDIAL ALTERNATIVE								COMMENTS
		PHYSICAL HAZARDS/SOLID MEDIA							
		ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT			
						In-situ	Ex-situ		
	No Action	Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Blending and Co-Disposal	Neutralization W/Alkaline Amendment	
Stevens Gulch Drainage									
SG-13/14, SG-16, SG-43	Yes	No	Yes	Yes	Yes	Yes	No	No	These features are all located at the top of the ridge dividing Mike Horse and Stevens Gulches. Access will require construction of an extensive road network in steep, heavily timbered areas.
SG-24, SG-44, SG-53, SG-55 SG-56, SG-58, SG-67, SG-98	Yes	No	Yes	Yes	Yes	Yes	No	No	These sites are located fairly high up in the drainage, with SG-44 and SG-98 being associated with the Viking mine site, situated near the top of the drainage. Access will require constructing an extensive network of roads along the west side of Stevens Gulch.
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78, SG-82 SG-94, SG-95, SG-96, SG-99	Yes	No	Yes	Yes	Yes	Yes	No	No	All of these sites are located along Stevens Creek. Access will be difficult and may require pioneering a road directly alongside the stream, or constructing multiple, switch-back roads along the steep valley slopes.
SG-01, SG-31, SG-33, SG-35 SG-86, SG-89	Yes	Yes	Yes	Yes	Yes	Yes	No	No	SG-01 is a partially open 8-inch well requiring a physical barrier. Relatively easy access to all sites. SG-31, 33, and 35 are in close proximity to Stevens Creek.
Swamp Gulch Drainage									
SWG-02	Yes	No	Yes	Yes	Yes	Yes	No	No	No existing roads to access this waste rock site, located 300 feet NE of Highway 200 on a heavily timbered, steep slope.

[4]Mine features are grouped by drainage basin. Within each basin, the features are grouped by proximity and/or common access road.

Table 13 - Preferred Alternatives Cost Analysis for the UBMC

Alternatives	(1) No Action	(2) Monitored Natural Recovery - MNR	(3) Physical Barriers	(4) Containment (earthen/rock cap)	(5) Removal & Onsite Disposal	(9) Monitored Natural Attenuation - MNA	(10) Containment (Retention Pond)	(11) Hydrologic and Hydraulic Control	(13) Active Chemical Reagent	(14) Active Physical/Mechanical Treatment	(15) Passive Chemical Reagent: Permeable Reactive Barrier -	Site-wide Elements	Total Costs per EA
Evaluation Area 1 (EA 1) - Upland Waste Areas (soil)	EU5 and EU9A Cost: $0			Portions of EU8 Cost: $349,823 Appendix A: EA1 (pp 5-7)	EU4, EU6, EU7, portion of EU8, and EU10 Cost: $843,155 Appendix A: EA1 (pp 8-10)							EU1A, EU1B, and EU3 (Access Restrictions) Cost: $58,401 Appendix A: EA1 (p 2)	$1,251,379
Evaluation Area 2 (EA 2) - Groundwater								Carbonate Surface Water and Groundwater Cost: $464,514 Appendix A: EA2 (p 5)	Mike Horse and Anaconda Adits Cost: $4,770,796 Appendix A: EA2 (p 8)	Mike Horse and Anaconda Adits Cost: $4,770,796 Appendix A: EA2 (p 11)	Carbonate Groundwater PRB Cost: $1,830,977 Appendix A: EA2 (p 14)	Carbonate, Paymaster, and Mike Horse (Groundwater ICs) Cost: $15,000 Appendix A: EA2 (p 1)	$11,852,083
Evaluation Area 3 (EA 3) - Streams (sediment and surface water)		Blackfoot River, Upper Marsh, and Un-named Tributary Cost: $724,113 Appendix A: EA3 (p 4)			Paymaster Creek Cost: $99,483 Appendix A: EA3 (pp 7-9)		Paymaster Adit Cost: $41,877 Appendix A: EA3 (pp 15-16)						$865,473
Evaluation Area 4 (EA 4) - Upper Marsh (sediment and water)		Upper Marsh - Western Portion Cost: $182,846* Appendix A: EA4 (pp 2-3) *Prorated based on private land in Upper Marsh			Upper Marsh - Eastern Portion Cost: $71,442* Appendix A: EA4 (p 7) *Prorated based on private land in Upper Marsh	Upper Marsh - East and West Cost: $13,306* Appendix A: EA4 (p 10) *Prorated based on private land in Upper Marsh						Upper Marsh - East and West (Access Restrictions and ICs) Cost: $527* Appendix A: EA4 (p 1) *Prorated based on private land in Upper Marsh	$97,160
Evaluation Area 5 (EA 5) - Mining-related Features			Mining-related Feature PC-01 Cost: $60,596** Appendix A: EA5 (p 4)		Mining-related Features BR-14, BR-39, PM-04, SH-13, and SH-29 Cost: $398,390** Appendix A: EA4 (pp 9-11)							Mining-related Features (18 Remote Features) Cost: $34,520** Appendix A: EA5 (pp 2-3)	$493,506
Total Costs per Remedy	$0	$735,998*	$60,596	$349,823	$1,412,470	$13,306	$41,877	$464,514	$4,770,796	$4,770,796	$1,830,977	$108,448	**$13,823,603**

* The level of monitoring for this area is expected to change over time, causing the estimated cost to decrease over time.

** Costs are prorated per number of Features that are on private land.

Red = Detailed Cost Analysis by Alternative and EA. Appendix A is divided into sections by EAs.

Note: The cost estimates do not include federal land cleanup costs. The cost estimate is based on the assumption that the alternatives will meet the estimated cleanup timeframes and these are preliminary estimates only. Actual costs and cleanup timeframes may vary and cost estimates will be further refined during remedial design.

APPENDIX A. COST ESTIMATES

Note: Some cost estimates for the same alternative differ by a small amount, which is due to rounding differences between the spreadsheets. However, the cost differences do not materially affect the cost or evaluation of costs.

TABLE A-1: UBMC FS COST SUMMARY TABLE

	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS														
					PHYSICAL HAZARDS/SOLID MEDIA							SURFACE WATER/GROUNDWATER						
						ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT			ENGINEERING CONTROLS			TREATMENT		
										In-situ	Ex-situ					Active		Passive
	ICs*	Access Restrictions	Long-term Monitoring and Maintenance**	No Action	Monitored Natural Recovery	Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Neutralization W/Alkaline Amendment	Monitored Natural Attenuation	Containment (Retention Pond)	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
TOTAL COST	**$25,000**	**$507,514**	**$1,979,427**	**$0**	**$2,545,823**	**$193,845**	**$16,064,459**	**$23,436,794**	**$29,625,091**	**$4,311,101**	**$2,317,210**	**$2,311,332**	**$1,116,380**	**$464,514**	**$10,124**	**$17,456,250**	**$17,456,250**	**$7,827,027**

SITE-WIDE ELEMENTS TOTAL	**$2,511,941**

* Based on $5,000 per IC, Assumed total of 5 ICs

** Based on current monitoring annual budget of $130,000 continuing; Present Value at 3% discounted over 15 years + Long term monitoring & maintenance of fencing for 30 years.

TABLE A-1: UBMC FS COST SUMMARY TABLE

	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS														
					PHYSICAL HAZARDS/SOLID MEDIA							SURFACE WATER/GROUNDWATER						
						ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT			ENGINEERING CONTROLS			TREATMENT		
										In-situ	Ex-situ					Active		Passive
	ICs*	Access Restrictions	Long-term Monitoring and Maintenance**	No Action	Monitored Natural Recovery	Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Neutralization W/Alkaline Amendment	Monitored Natural Attenuation	Containment (Retention Pond)	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
TOTAL COST	**$25,000**	**$507,514**	**$1,979,427**	**$0**	**$2,545,823**	**$193,845**	**$16,064,459**	**$23,436,794**	**$29,625,091**	**$4,311,101**	**$2,317,210**	**$2,311,332**	**$1,116,380**	**$464,514**	**$10,124**	**$17,456,250**	**$17,456,250**	**$7,827,027**

SITE WIDE ELEMENTS TOTAL	**$2,511,941**

* Based on $5,000 per IC, Assumed total of 5 Ics

** Based on current monitoring annual budget of $130,000 continuing; Present Value at 3% discounted over 15 years + Long term monitoring & maintenance of fencing for 30 years.

Table A2 - Alternatives Comparison for UBMC								
Alternatives	Protectiveness	Compliance w/ERCLs	Mitigation of Risk	Effectiveness & Reliability	Implementability & Practicability	Treatment or Resource Recovery Technologies	Years to Implementation	Estimated Present Worth Cost @ 3%
1 No Action	No	No	No	No	Yes	No	30	$ -
2 Monitored Natural Recovery	Yes (when combined)	Yes (when combined)	Yes (long-term when combined)	Yes, can be effective and reliable when combined with other source control or removal actions.	Yes	No	30	$ 2,545,823
3 Physical Barriers	Yes (when combined)	Yes (when combined)	Yes (eliminates intentional or accidental access) No (doesn't address risk to human health and environment from COCs)	Yes, is effective and reliable for eliminating access to open adits and other physical hazards.	Yes	No	30	$ 193,845
4 Containment (Earthen/Rock Cap)	Yes (when combined)	Yes (when combined)	Yes (mitigates risk caused by direct contact with COCs) No (doesn't protect groundwater from COCs)	Yes, but O&M would be required to maintain the integrity of the cap.	Yes	No	30	$ 16,064,459
5 Removal & On-site Disposal	Yes (when combined)	Yes (when combined)	Yes (mitigates risk of COCs exceeding SSCLs) No (doesn't mitigate all risk from arsenic and lead)	Yes, but construction BMPs may be needed to reduce adverse short-term effects on surface water from the construction activities.	Yes, but removal may be difficult in some locations due to steep terrain, remoteness and inadequate access.	No	30	$ 23,436,794
6 Removal & Off-site Disposal	Yes (when combined)	Yes (when combined)	Yes (mitigates risk of COCs exceeding SSCLs) No (doesn't mitigate all risk from arsenic and lead)	Yes, but construction BMPs may be needed to reduce adverse short-term effects on surface water from the construction activities.	Yes, but removal may be difficult in some locations due to steep terrain, remoteness and inadequate access.	No	30	$ 29,625,091
7 In Situ Neutralization w/Alkaline Amendment	Yes (when combined)	Yes (when combined)	Yes (mitigates risk caused by direct contact with COCs) No (doesn't protect groundwater from COCs)	Yes, but construction BMPs may be needed to reduce adverse short-term effects on surface water from the construction activities.	Yes, but amendment may be difficult in some locations due to steep terrain, remoteness and inadequate access.	Yes - alkaline amendment to soil.	30	$ 4,311,101
8 Ex Situ Neutralization w/Alkaline Amendment	Yes (when combined)	Yes (when combined)	Yes (mitigates risk caused by direct contact with COCs) No (doesn't protect groundwater from COCs)	Yes, but construction BMPs may be needed to reduce adverse short-term effects on surface water from the construction activities.	Yes, but amendment may be difficult in some locations due to steep terrain, remoteness and inadequate access.	Yes - alkaline amendment to soil.	30	$ 2,317,210
9 Monitored Natural Attenuation	Yes (when combined)	Yes (when combined)	Yes (long-term when combined, but the process is complex and difficult to predict with inorganic COCs)	Yes, can be effective and reliable when combined with other source control or removal actions.	Yes	No	30	$ 2,311,332
10 Containment (Retention Pond)	Yes (when combined)	Yes (when combined)	Yes (risk exposure downstream of the pond would be mitigated) No (water discharge exceeding the SSCLs may remain on the surface and become concentrated within the retention pond)	Yes, but O&M would be required to maintain the integrity of the remedy and ensure continued performance as designed.	Yes, but construction may be difficult in some locations due to steep terrain, remoteness and inadequate access.	No	30	$ 1,116,380

11 Hydrologic & Hydraulic Control	Yes (when combined)	Yes (when combined)	There is no mitigation of exposures to risk to human health and the environment under this alternative.	No, but when combined with a PRB, it may reduce the quantity of groundwater that would need to be treated.	Yes	No	30	$ 464,514
12 Inundation	Yes (when combined)	Yes (when combined)	Mitigates the risks to human health and the environment by keeping the adit discharge contained in the adit. Continued risk may be present if new uncontrolled seeps develop.	Yes, is highly effective and reliable in both the short-term and long-term.	Yes	No	30	$ 10,124
13 Active Chemical Reagent	Yes (when combined)	Yes (when combined)	No mitigation of risk from exposure to contaminated groundwater with this alternative, but if combined with other alternatives, some mitigation of risk may be achieved.	No, but when combined with ceramic microfiltration, has proven to be effective and reliable at the existing WTP.	Yes, it is practicable and implementable in its current configuration.	Yes - sodium hydroxide addition.	30	$ 17,456,250
14 Active Physical/Mechanical Treatment	Yes (when combined)	Yes (when combined)	No mitigation of risk from exposure to contaminated groundwater with this alternative, but if combined with other alternatives, some mitigation of risk may be achieved.	No, but when combined with alkaline amendment, has proven to be effective and reliable at the existing WTP.	Yes, it is practicable and implementable in its current configuration.	Yes - ceramic microfiltration.	30	$ 17,456,250
15 Passive Chemical Reagent: Permeable Reactive Barrier	Yes (when combined)	Yes (when combined)	Yes, there is mitigation of exposures to risk because concentrations of cadmium and other metals in the groundwater leaving the Carbonate Mine site would be significantly reduced.	Yes, but O&M would be required to maintain the integrity of the remedy and ensure continued performance as designed.	Additional site investigations and pilot studies are needed to ensure optimization of the designs.	Yes - PRB	30	$ 7,827,027
Site-wide Elements	Yes (when combined)	Yes (when combined)	Yes (when combined)	Yes	Yes	No	30	$ 2,511,941

EVALUATION AREA	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS						
EA 1					PHYSICAL HAZARDS/SOLID MEDIA					
					ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT	
									In-situ	Ex-situ
Upland Waste Areas	ICs	Access Restrictions	Long-term Monitoring and Maintenance	No Action	Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Neutralization W/Alkaline Amendment
Upper Anaconda Mine (EU 1A) Waste Area	$0	$16,310.47	$10,607.49	$0	N/A	$447,749	$387,715	$570,281	$193,581	$434,848
Upper Anaconda Mine (EU 1B) Waste Piles	$0	$8,941.78	$8,029.03	$0	N/A	$96,093	$109,495	$168,977	$40,886	$126,079
Capital Mine (EU 3) Waste Area	$0	$7,120.31	$7,391.66	$0	N/A	$184,095	$177,343	$197,877	$155,508	$182,644
Carbonate Mine (EU 4) Waste Area	$0	$14,406.20	$9,941.14	$0	N/A	$299,327	$254,686	$390,443	$110,326	$289,734
Edith Mine (EU 5) Waste Area	$0	$9,935.31	$8,376.68	$0	N/A	$125,326	$107,980	$160,730	$51,888	$121,599
Consolation Mine (EU 6) Waste Area	$0	$11,591.20	$8,956.11	$0	N/A	$221,279	$195,181	$274,547	$110,785	$215,670
Mary P Mine (EU 7) Waste Pile	$0	$5,381.63	$6,783.25	$0	N/A	$21,914	$24,615	$36,603	$10,787	$27,957
Mike Horse Mine (EU 8) Waste Area	$0	$20,781.36	$12,171.95	$0	N/A	$699,645	$594,424	$914,407	$254,166	$677,033
Paymaster Mine (EU 9A) Waste Area - Surface	$0	$6,375.16	$7,130.91	$0	N/A	$37,326	$32,527	$47,122	$17,007	$36,295
Paymaster Mine (EU 9B) Waste Area - Subsurface	$0	$5,795.60	$2,028.00	$0	N/A	$60,221	$105,737	$170,096	$28,605	$124,344
No. 3 Tunnel Mine (EU 10) Waste Area	$0	$8,693.40	$7,942.11	$0	N/A	$83,621	$71,461	$108,440	$32,140	$81,008
TOTAL COSTS	**$0**	**$115,332**	**$89,358**	**$0**	**N/A**	**$2,276,597**	**$2,061,165**	**$3,039,523**	**$1,005,680**	**$2,317,210**

EA 1 COSTS													
SITE-WIDE ELEMENTS	**Upper Anaconda Mine (EU 1A) Waste Area**	**Upper Anaconda Mine (EU 1B) Waste Piles**	**Capital Mine (EU 3) Waste Area**	**Carbonate Mine (EU 4) Waste Area**	**Edith Mine (EU 5) Waste Area**	**Consolation Mine (EU 6) Waste Area**	**Mary P Mine (EU 7) Waste Pile**	**Mike Horse Mine (EU 8) Waste Area**	**Paymaster Mine (EU 9A) Waste Area - Surface**	**Paymaster Mine (EU 9B) Waste Area - Subsurface**	**No. 3 Tunnel Mine (EU 10) Waste Area**		**TOTAL**
Access Restrictions													
Construct Fence	$ 9,185	$ 4,290	$ 3,080	$ 7,920	$ 4,950	$ 6,050	$ 1,925	$ 12,155	$ 2,585	$ 3,850	$ 4,125		**$ 60,115**
Install Gates	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ -	$ 1,500		**$ 15,000**
Install Warning Signs	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ -	$ 150		**$ 1,500**
Subtotal	$ 10,835	$ 5,940	$ 4,730	$ 9,570	$ 6,600	$ 7,700	$ 3,575	$ 13,805	$ 4,235	$ 3,850	$ 5,775		**$ 76,615**
Mob/Demob (10%)	$ 1,084	$ 594	$ 473	$ 957	$ 660	$ 770	$ 358	$ 1,381	$ 424	$ 385	$ 578		**$ 7,662**
Subtotal	$ 11,919	$ 6,534	$ 5,203	$ 10,527	$ 7,260	$ 8,470	$ 3,933	$ 15,186	$ 4,659	$ 4,235	$ 6,353		**$ 84,277**
Contingencies (15%)	$ 1,788	$ 980	$ 780	$ 1,579	$ 1,089	$ 1,271	$ 590	$ 2,278	$ 699	$ 635	$ 953		**$ 12,641**
Subtotal	$ 13,706	$ 7,514	$ 5,983	$ 12,106	$ 8,349	$ 9,741	$ 4,522	$ 17,463	$ 5,357	$ 4,870	$ 7,305		**$ 96,918**
Project Management (5%)	$ 685	$ 376	$ 299	$ 605	$ 417	$ 487	$ 226	$ 873	$ 268	$ 244	$ 365		**$ 4,846**
Engineering (6%)	$ 822	$ 451	$ 359	$ 726	$ 501	$ 584	$ 271	$ 1,048	$ 321	$ 292	$ 438		**$ 5,815**
Construction Administration (8%)	$ 1,097	$ 601	$ 479	$ 968	$ 668	$ 779	$ 362	$ 1,397	$ 429	$ 390	$ 584		**$ 7,753**
Total, Capital Cost	$ 16,310	$ 8,942	$ 7,120	$ 14,406	$ 9,935	$ 11,591	$ 5,382	$ 20,781	$ 6,375	$ 5,796	$ 8,693		**$ 115,332**
Long Term Monitoring and Maintenance (M&M)													
Site Security, Fence and Sign Maintenance, Years 1-30 (Annual)	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ -	$ 250		**$ 2,500**
Periodic Replacement - Years 15 and 30	$ 5,418	$ 2,970	$ 2,365	$ 4,785	$ 3,300	$ 3,850	$ 1,788	$ 6,903	$ 2,118	$ 1,925	$ 2,888		**$ 38,308**
Total, 30-yr Present Worth, Long Term M&M (3%)	$ 10,607	$ 8,029	$ 7,392	$ 9,941	$ 8,377	$ 8,956	$ 6,783	$ 12,172	$ 7,131	$ 2,028	$ 7,942		**$ 89,358**
TOTAL CAPITAL COST + M&M	$ 26,918	$ 16,971	$ 14,512	$ 24,347	$ 18,312	$ 20,547	$ 12,165	$ 32,953	$ 13,506	$ 7,824	$ 16,636		**$ 204,691**
TOTAL SITE-WIDE ELEMENTS COSTS WITH 30-YR PRESENT WORTH LONG TERM M&M													**$ 204,691**

EA1 COST ESTIMATE DETAIL
SITE -WIDE ELEMENTS

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 7,661.50	1	$ 7,662	10% of construction cost
Install Farm Fence - Total	LF	$ 5.50	10,930	$ 60,115	Based on Bald Butte/Great Divide
Upper Anaconda Mine (EU 1A) Waste Area	LF	$ 5.50	1,670	$ 9,185	
Upper Anaconda Mine (EU 1B) Waste Piles	LF	$ 5.50	780	$ 4,290	
Capital Mine (EU 3) Waste Area	LF	$ 5.50	560	$ 3,080	
Carbonate Mine (EU 4) Waste Area	LF	$ 5.50	1,440	$ 7,920	
Edith Mine (EU 5) Mine Waste	LF	$ 5.50	900	$ 4,950	
Consolation Mine (EU 6) Waste Area	LF	$ 5.50	1,100	$ 6,050	
Mary P Mine (EU 7) Waste Pile	LF	$ 5.50	350	$ 1,925	
Mike Horse Mine (EU 8) Waste Area	LF	$ 5.50	2,210	$ 12,155	
Paymaster Mine (EU 9A) Waste Area - Surface	LF	$ 5.50	470	$ 2,585	
Paymaster Mine (EU 9B) Waste Area - Subsurface	LF	$ 5.50	700	$ 3,850	
No. 3 Tunnel Mine (EU 10) Waste Area	LF	$ 5.50	750	$ 4,125	
Metal Security Gate - Total	EA	$ 1,500.00	10	$ 15,000	Based on Section 35 Bid Tabs
Upper Anaconda Mine (EU 1A) Waste Area	EA	$ 1,500.00	1	$ 1,500	
Upper Anaconda Mine (EU 1B) Waste Piles	EA	$ 1,500.00	1	$ 1,500	
Capital Mine (EU 3) Waste Area	EA	$ 1,500.00	1	$ 1,500	
Carbonate Mine (EU 4) Waste Area	EA	$ 1,500.00	1	$ 1,500	
Edith Mine (EU 5) Mine Waste	EA	$ 1,500.00	1	$ 1,500	
Consolation Mine (EU 6) Waste Area	EA	$ 1,500.00	1	$ 1,500	
Mary P Mine (EU 7) Waste Pile	EA	$ 1,500.00	1	$ 1,500	
Mike Horse Mine (EU 8) Waste Area	EA	$ 1,500.00	1	$ 1,500	
Paymaster Mine (EU 9A) Waste Area - Surface	EA	$ 1,500.00	1	$ 1,500	
Paymaster Mine (EU 9B) Waste Area - Subsurface	EA	$ 1,500.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	EA	$ 1,500.00	1	$ 1,500	
Metal Warning Signs - Total	EA	$ 150.00	10	$ 1,500	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	EA	$ 150.00	1	$ 150	
Upper Anaconda Mine (EU 1B) Waste Piles	EA	$ 150.00	1	$ 150	
Capital Mine (EU 3) Waste Area	EA	$ 150.00	1	$ 150	
Carbonate Mine (EU 4) Waste Area	EA	$ 150.00	1	$ 150	
Edith Mine (EU 5) Mine Waste	EA	$ 150.00	1	$ 150	
Consolation Mine (EU 6) Waste Area	EA	$ 150.00	1	$ 150	
Mary P Mine (EU 7) Waste Pile	EA	$ 150.00	1	$ 150	
Mike Horse Mine (EU 8) Waste Area	EA	$ 150.00	1	$ 150	
Paymaster Mine (EU 9A) Waste Area - Surface	EA	$ 150.00	1	$ 150	
Paymaster Mine (EU 9B) Waste Area - Subsurface	EA	$ 150.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	EA	$ 150.00	1	$ 150	
			Subtotal	$ 84,277	
Contingencies		15%		$ 12,641.48	
			Subtotal	$ 96,918	
Project Management		5%		$ 4,846	
Engineering		6%		$ 5,815	
Construction Management		8%		$ 7,753	
TOTAL				$ 115,332	
			TOTAL CAPITAL COSTS	**$ 115,332**	

EA1 COST ESTIMATE DETAIL
SITE -WIDE ELEMENTS

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES

LONG TERM MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Security, Fence and Sign Maintenance, Years 1-30	LS	$ 2,500.00	1	$ 2,500	Engineers Estimate
Periodic Replacement - Years 15 and 30	LS	$ 38,307.50	1	$ 38,308	1/2 of fence replaced
			Subtotal	$ 40,808	
30-YEAR NET PRESENT VALUE ANNUAL M&M COSTS				**$89,371**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (ICS + ACCESS RESTRICTIONS + M&M COSTS) **$204,704** Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 1 COSTS													
CONTAINMENT	**Upper Anaconda Mine (EU 1A) Waste Area**	**Upper Anaconda Mine (EU 1B) Waste Piles**	**Capital Mine (EU 3) Waste Area**	**Carbonate Mine (EU 4) Waste Area**	**Edith Mine (EU 5) Waste Area**	**Consolation Mine (EU 6) Waste Area**	**Mary P Mine (EU 7) Waste Pile**	**Mike Horse Mine (EU 8) Waste Area**	**Paymaster Mine (EU 9A) Waste Area - Surface**	**Paymaster Mine (EU 9B) Waste Area - Subsurface**	**No. 3 Tunnel Mine (EU 10) Waste Area**		**TOTAL**
Improve/Construct Access Roads	$ 36,000	$ 4,500	$ 90,000	$ 3,600	$ 5,400	$ 31,500	$ -	$ 9,000	$ 900	$ -	$ -		$ 180,900
Re-Grade Waste Piles, Prep for Cover Soil Placement	$ 48,520	$ 10,539	$ 5,457	$ 36,080	$ 14,019	$ 21,093	$ 2,124	$ 85,041	$ 3,879	$ 8,552	$ 9,828		$ 245,134
Load, Haul, Place Vegetative Cover	$ 161,734	$ 35,130	$ 18,191	$ 120,267	$ 46,731	$ 70,311	$ 7,080	$ 283,471	$ 12,930	$ 28,508	$ 32,759		$ 817,112
Seed, Fertilize, Mulch	$ 6,683	$ 1,452	$ 752	$ 4,970	$ 1,931	$ 2,905	$ 293	$ 11,714	$ 534	$ 1,178	$ 1,354		$ 33,765
Reclaim Cover Soil Borrow Area	$ 10,025	$ 2,177	$ 1,128	$ 7,455	$ 2,897	$ 4,358	$ 439	$ 17,571	$ 801	$ 1,767	$ 2,031		$ 50,647
Subtotal	$ 262,963	$ 53,798	$ 115,527	$ 172,371	$ 70,978	$ 130,167	$ 9,935	$ 406,797	$ 19,045	$ 40,005	$ 45,971		$ 1,327,558
Mob/Demob (10%)	$ 26,296	$ 5,380	$ 11,553	$ 17,237	$ 7,098	$ 13,017	$ 994	$ 40,680	$ 1,904	$ 4,000	$ 4,597		$ 132,756
Subtotal	$ 289,259	$ 59,178	$ 127,080	$ 189,608	$ 78,076	$ 143,184	$ 10,929	$ 447,477	$ 20,949	$ 44,005	$ 50,568		$ 1,460,314
Contingencies (15%)	$ 43,389	$ 8,877	$ 19,062	$ 28,441	$ 11,711	$ 21,478	$ 1,639	$ 67,122	$ 3,142	$ 6,601	$ 7,585		$ 219,047
Subtotal	$ 332,648	$ 68,055	$ 146,142	$ 218,050	$ 89,787	$ 164,662	$ 12,568	$ 514,598	$ 24,092	$ 50,606	$ 58,153		$ 1,679,361
Project Management (5%)	$ 16,632	$ 3,403	$ 7,307	$ 10,902	$ 4,489	$ 8,233	$ 628	$ 25,730	$ 1,205	$ 2,530	$ 2,908		$ 83,968
Engineering (6%)	$ 19,959	$ 4,083	$ 8,769	$ 13,083	$ 5,387	$ 9,880	$ 754	$ 30,876	$ 1,445	$ 3,036	$ 3,489		$ 100,762
Construction Administration (8%)	$ 26,612	$ 5,444	$ 11,691	$ 17,444	$ 7,183	$ 13,173	$ 1,005	$ 41,168	$ 1,927	$ 4,048	$ 4,652		$ 134,349
Total, Capital Cost	$ 395,851	$ 80,985	$ 173,909	$ 259,479	$ 106,847	$ 195,948	$ 14,956	$ 612,372	$ 28,669	$ 60,221	$ 69,202		$ 1,998,439
Operations and Maintenance (O & M)													
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ -	$ 250		$ 2,500
Periodic Repairs - Years 15 and 30 (1/4th remedial cost)	$ 44,611	$ 9,690	$ 5,018	$ 33,173	$ 12,890	$ 19,394	$ 1,953	$ 78,189	$ 3,566	$ -	$ 9,036		$ 217,518
Total, 30-yr Present Worth, O & M (3%)	$ 51,898	$ 15,108	$ 10,186	$ 39,848	$ 18,479	$ 25,331	$ 6,957	$ 87,273	$ 8,657	$ -	$ 14,419		$ 278,158
TOTAL CAPITAL COST + O & M	$ 447,749	$ 96,093	$ 184,095	$ 299,327	$ 125,326	$ 221,279	$ 21,914	$ 699,645	$ 37,326	$ 60,221	$ 83,621		$ 2,276,597
TOTAL EA1 CONTAINMENT COSTS WITH 30-YR PRESENT WORTH O & M													**$ 2,276,597**

EA1 COST ESTIMATE DETAIL
CONTAINMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 132,755.77	1	$ 132,756	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	10,050	$ 180,900	Includes Clear/Grub/Log, Reclamation
Upper Anaconda Mine (EU 1A) Waste Area	LF	$ 18.00	2,000	$ 36,000	
Upper Anaconda Mine (EU 1B) Waste Piles	LF	$ 18.00	250	$ 4,500	
Capital Mine (EU 3) Waste Area	LF	$ 18.00	5,000	$ 90,000	
Carbonate Mine (EU 4) Waste Area	LF	$ 18.00	200	$ 3,600	
Edith Mine (EU 5) Mine Waste	LF	$ 18.00	300	$ 5,400	
Consolation Mine (EU 6) Waste Area	LF	$ 18.00	1,750	$ 31,500	
Mary P Mine (EU 7) Waste Pile	LF	$ 18.00	0	$ -	
Mike Horse Mine (EU 8) Waste Area	LF	$ 18.00	500	$ 9,000	
Paymaster Mine (EU 9A) Waste Area - Surface	LF	$ 18.00	50	$ 900	
Paymaster Mine (EU 9B) Waste Area - Subsurface	LF	$ 18.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	LF	$ 18.00	0	$ -	
Re-Grade Waste Piles, Prep for Cover Soil Placement - Total	SY	$ 3.00	81,711	$ 245,134	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	SY	$ 3.00	16,173	$ 48,520	
Upper Anaconda Mine (EU 1B) Waste Piles	SY	$ 3.00	3,513	$ 10,539	
Capital Mine (EU 3) Waste Area	SY	$ 3.00	1,819	$ 5,457	
Carbonate Mine (EU 4) Waste Area	SY	$ 3.00	12,027	$ 36,080	
Edith Mine (EU 5) Mine Waste	SY	$ 3.00	4,673	$ 14,019	
Consolation Mine (EU 6) Waste Area	SY	$ 3.00	7,031	$ 21,093	
Mary P Mine (EU 7) Waste Pile	SY	$ 3.00	708	$ 2,124	
Mike Horse Mine (EU 8) Waste Area	SY	$ 3.00	28,347	$ 85,041	
Paymaster Mine (EU 9A) Waste Area - Surface	SY	$ 3.00	1,293	$ 3,879	
Paymaster Mine (EU 9B) Waste Area - Subsurface	SY	$ 3.00	2,851	$ 8,552	
No. 3 Tunnel Mine (EU 10) Waste Area	SY	$ 3.00	3,276	$ 9,828	
Load, Haul, Place Vegetative Cover - Total	CY	$ 15.00	54,474	$ 817,112	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 15.00	10,782	$ 161,734	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 15.00	2,342	$ 35,130	
Capital Mine (EU 3) Waste Area	CY	$ 15.00	1,213	$ 18,191	
Carbonate Mine (EU 4) Waste Area	CY	$ 15.00	8,018	$ 120,267	
Edith Mine (EU 5) Mine Waste	CY	$ 15.00	3,115	$ 46,731	
Consolation Mine (EU 6) Waste Area	CY	$ 15.00	4,687	$ 70,311	
Mary P Mine (EU 7) Waste Pile	CY	$ 15.00	472	$ 7,080	
Mike Horse Mine (EU 8) Waste Area	CY	$ 15.00	18,898	$ 283,471	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 15.00	862	$ 12,930	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 15.00	1,901	$ 28,508	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 15.00	2,184	$ 32,759	
Seed, Fertilize, Mulch - Total	AC	$ 2,000.00	16.9	$ 33,765	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 2,000.00	3.3	$ 6,683	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 2,000.00	0.7	$ 1,452	
Capital Mine (EU 3) Waste Area	AC	$ 2,000.00	0.4	$ 752	
Carbonate Mine (EU 4) Waste Area	AC	$ 2,000.00	2.5	$ 4,970	
Edith Mine (EU 5) Mine Waste	AC	$ 2,000.00	1.0	$ 1,931	
Consolation Mine (EU 6) Waste Area	AC	$ 2,000.00	1.5	$ 2,905	
Mary P Mine (EU 7) Waste Pile	AC	$ 2,000.00	0.1	$ 293	
Mike Horse Mine (EU 8) Waste Area	AC	$ 2,000.00	5.9	$ 11,714	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 2,000.00	0.3	$ 534	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 2,000.00	0.6	$ 1,178	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 2,000.00	0.7	$ 1,354	

EA1 COST ESTIMATE DETAIL
CONTAINMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500.00	11.3	$ 50,647	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 4,500.00	2.2	$ 10,025	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 4,500.00	0.5	$ 2,177	
Capital Mine (EU 3) Waste Area	AC	$ 4,500.00	0.3	$ 1,128	
Carbonate Mine (EU 4) Waste Area	AC	$ 4,500.00	1.7	$ 7,455	
Edith Mine (EU 5) Mine Waste	AC	$ 4,500.00	0.6	$ 2,897	
Consolation Mine (EU 6) Waste Area	AC	$ 4,500.00	1.0	$ 4,358	
Mary P Mine (EU 7) Waste Pile	AC	$ 4,500.00	0.1	$ 439	
Mike Horse Mine (EU 8) Waste Area	AC	$ 4,500.00	3.9	$ 17,571	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 4,500.00	0.2	$ 801	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 4,500.00	0.4	$ 1,767	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 4,500.00	0.5	$ 2,031	
			Subtotal	$ 1,460,314	
Contingencies		15%		$ 219,047	
			Subtotal	$ 1,679,361	
Project Management		5%		$ 83,968	
Engineering		6%		$ 100,762	
Construction Management		8%		$ 134,349	
TOTAL				$ 1,998,439	
			TOTAL CAPITAL COSTS	**$ 1,998,439**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 2,500.00	1	$ 2,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/4th remedial cost, re-cover soil, reveg)	LS	$ 217,517.92	1	$ 217,518	Engineers Estimate
			Subtotal	$ 220,018	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 278,232**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COSTS) $ 2,276,671 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 1 COSTS													
REMOVAL AND ON-SITE DISPOSAL	**Upper Anaconda Mine (EU 1A) Waste Area**	**Upper Anaconda Mine (EU 1B) Waste Piles**	**Capital Mine (EU 3) Waste Area**	**Carbonate Mine (EU 4) Waste Area**	**Edith Mine (EU 5) Waste Area**	**Consolation Mine (EU 6) Waste Area**	**Mary P Mine (EU 7) Waste Pile**	**Mike Horse Mine (EU 8) Waste Area**	**Paymaster Mine (EU 9A) Waste Area - Surface**	**Paymaster Mine (EU 9B) Waste Area - Subsurface**	**No. 3 Tunnel Mine (EU 10) Waste Area**		**TOTAL**
Improve/Construct Access Roads	$ 36,000	$ 4,500	$ 90,000	$ 3,600	$ 5,400	$ 31,500	$ -	$ 9,000	$ 900	$ -	$ -		$ 180,900
Excavate, Load, Haul and Place Waste in Repository	$ 161,734	$ 52,695	$ 18,191	$ 120,267	$ 46,731	$ 70,311	$ 10,620	$ 283,471	$ 12,930	$ 57,015	$ 32,759		$ 866,724
Load, Haul, Place Vegetative Cover	$ 40,434	$ 8,783	$ 4,548	$ 30,067	$ 11,683	$ 17,578	$ 1,770	$ 70,868	$ 3,233	$ 7,127	$ 8,190		$ 204,278
Seed, Fertilize, Mulch	$ 6,683	$ 1,452	$ 752	$ 4,970	$ 1,931	$ 2,905	$ 293	$ 11,714	$ 534	$ 1,178	$ 1,354		$ 33,765
Reclaim Cover Soil Borrow Area	$ 2,506	$ 544	$ 282	$ 1,864	$ 724	$ 1,090	$ 110	$ 4,393	$ 200	$ 442	$ 508		$ 12,662
Subtotal	$ 247,358	$ 67,974	$ 113,772	$ 160,767	$ 66,469	$ 123,383	$ 12,792	$ 379,446	$ 17,797	$ 65,762	$ 42,810		$ 1,298,329
Mob/Demob (10%)	$ 24,736	$ 6,797	$ 11,377	$ 16,077	$ 6,647	$ 12,338	$ 1,279	$ 37,945	$ 1,780	$ 6,576	$ 4,281		$ 129,833
Subtotal	$ 272,093	$ 74,771	$ 125,149	$ 176,844	$ 73,116	$ 135,722	$ 14,072	$ 417,390	$ 19,577	$ 72,338	$ 47,091		$ 1,428,162
Contingencies (15%)	$ 40,814	$ 11,216	$ 18,772	$ 26,527	$ 10,967	$ 20,358	$ 2,111	$ 62,609	$ 2,937	$ 10,851	$ 7,064		$ 214,224
Subtotal	$ 312,907	$ 85,987	$ 143,922	$ 203,370	$ 84,083	$ 156,080	$ 16,182	$ 479,999	$ 22,513	$ 83,188	$ 54,154		$ 1,642,386
Project Management (5%)	$ 15,645	$ 4,299	$ 7,196	$ 10,169	$ 4,204	$ 7,804	$ 809	$ 24,000	$ 1,126	$ 4,159	$ 2,708		$ 82,119
Engineering (6%)	$ 18,774	$ 5,159	$ 8,635	$ 12,202	$ 5,045	$ 9,365	$ 971	$ 28,800	$ 1,351	$ 4,991	$ 3,249		$ 98,543
Construction Administration (8%)	$ 25,033	$ 6,879	$ 11,514	$ 16,270	$ 6,727	$ 12,486	$ 1,295	$ 38,400	$ 1,801	$ 6,655	$ 4,332		$ 131,391
Total, Capital Cost	$ 372,360	$ 102,324	$ 171,267	$ 242,011	$ 100,059	$ 185,735	$ 19,257	$ 571,198	$ 26,791	$ 98,994	$ 64,444		$ 1,954,440
Operations and Maintenance (O & M)													
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250		$ 2,750
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	$ 9,925	$ 2,156	$ 1,116	$ 7,380	$ 2,868	$ 4,315	$ 434	$ 17,395	$ 793	$ 1,749	$ 2,010		$ 50,141
Total, 30-yr Present Worth, O & M (3%)	$ 15,356	$ 7,171	$ 6,076	$ 12,675	$ 7,921	$ 9,445	$ 5,358	$ 23,226	$ 5,736	$ 6,743	$ 7,018		$ 106,725
TOTAL CAPITAL COST + O & M	$ 387,715	$ 109,495	$ 177,343	$ 254,686	$ 107,980	$ 195,181	$ 24,615	$ 594,424	$ 32,527	$ 105,737	$ 71,461		$ 2,061,165
TOTAL EA1 REMOVAL AND ON-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O & M													**$ 2,061,165**

EA1 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 129,832.91	1	$ 129,833	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	10,050	$ 180,900	Includes Clear/Grub/Log, Reclamation
Upper Anaconda Mine (EU 1A) Waste Area	LF	$ 18.00	2,000	$ 36,000	
Upper Anaconda Mine (EU 1B) Waste Piles	LF	$ 18.00	250	$ 4,500	
Capital Mine (EU 3) Waste Area	LF	$ 18.00	5,000	$ 90,000	
Carbonate Mine (EU 4) Waste Area	LF	$ 18.00	200	$ 3,600	
Edith Mine (EU 5) Mine Waste	LF	$ 18.00	300	$ 5,400	
Consolation Mine (EU 6) Waste Area	LF	$ 18.00	1,750	$ 31,500	
Mary P Mine (EU 7) Waste Pile	LF	$ 18.00	0	$ -	
Mike Horse Mine (EU 8) Waste Area	LF	$ 18.00	500	$ 9,000	
Paymaster Mine (EU 9A) Waste Area - Surface	LF	$ 18.00	50	$ 900	
Paymaster Mine (EU 9B) Waste Area - Subsurface	LF	$ 18.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	LF	$ 18.00	0	$ -	
Excavate, Load, Haul and Place Waste in Repository - Total	CY	$ 15.00	57,782	$ 866,724	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 15.00	10,782	$ 161,734	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 15.00	3,513	$ 52,695	
Capital Mine (EU 3) Waste Area	CY	$ 15.00	1,213	$ 18,191	
Carbonate Mine (EU 4) Waste Area	CY	$ 15.00	8,018	$ 120,267	
Edith Mine (EU 5) Mine Waste	CY	$ 15.00	3,115	$ 46,731	
Consolation Mine (EU 6) Waste Area	CY	$ 15.00	4,687	$ 70,311	
Mary P Mine (EU 7) Waste Pile	CY	$ 15.00	708	$ 10,620	
Mike Horse Mine (EU 8) Waste Area	CY	$ 15.00	18,898	$ 283,471	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 15.00	862	$ 12,930	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 15.00	3,801	$ 57,015	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 15.00	2,184	$ 32,759	
Load, Haul, Place Vegetative Cover - Total	CY	$ 15.00	13,619	$ 204,278	6 inch cover imported over removal areas
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 15.00	2,696	$ 40,434	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 15.00	586	$ 8,783	
Capital Mine (EU 3) Waste Area	CY	$ 15.00	303	$ 4,548	
Carbonate Mine (EU 4) Waste Area	CY	$ 15.00	2,004	$ 30,067	
Edith Mine (EU 5) Mine Waste	CY	$ 15.00	779	$ 11,683	
Consolation Mine (EU 6) Waste Area	CY	$ 15.00	1,172	$ 17,578	
Mary P Mine (EU 7) Waste Pile	CY	$ 15.00	118	$ 1,770	
Mike Horse Mine (EU 8) Waste Area	CY	$ 15.00	4,725	$ 70,868	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 15.00	216	$ 3,233	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 15.00	475	$ 7,127	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 15.00	546	$ 8,190	
Seed, Fertilize, Mulch - Total	AC	$ 2,000.00	16.9	$ 33,765	Based on Bald Butte
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 2,000.00	3.3	$ 6,683	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 2,000.00	0.7	$ 1,452	
Capital Mine (EU 3) Waste Area	AC	$ 2,000.00	0.4	$ 752	
Carbonate Mine (EU 4) Waste Area	AC	$ 2,000.00	2.5	$ 4,970	
Edith Mine (EU 5) Mine Waste	AC	$ 2,000.00	1.0	$ 1,931	
Consolation Mine (EU 6) Waste Area	AC	$ 2,000.00	1.5	$ 2,905	
Mary P Mine (EU 7) Waste Pile	AC	$ 2,000.00	0.1	$ 293	
Mike Horse Mine (EU 8) Waste Area	AC	$ 2,000.00	5.9	$ 11,714	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 2,000.00	0.3	$ 534	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 2,000.00	0.6	$ 1,178	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 2,000.00	0.7	$ 1,354	

EA1 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500.00	2.8	$ 12,662	Based on Bald Butte
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 4,500.00	0.6	$ 2,506	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 4,500.00	0.1	$ 544	
Capital Mine (EU 3) Waste Area	AC	$ 4,500.00	0.1	$ 282	
Carbonate Mine (EU 4) Waste Area	AC	$ 4,500.00	0.4	$ 1,864	
Edith Mine (EU 5) Mine Waste	AC	$ 4,500.00	0.2	$ 724	
Consolation Mine (EU 6) Waste Area	AC	$ 4,500.00	0.2	$ 1,090	
Mary P Mine (EU 7) Waste Pile	AC	$ 4,500.00	0.0	$ 110	
Mike Horse Mine (EU 8) Waste Area	AC	$ 4,500.00	1.0	$ 4,393	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 4,500.00	0.0	$ 200	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 4,500.00	0.1	$ 442	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 4,500.00	0.1	$ 508	
			Subtotal	$ 1,428,162	
Contingencies		15%		$ 214,224	
			Subtotal	$ 1,642,386	
Project Management		5%		$ 82,119	
Engineering		6%		$ 98,543	
Construction Management		8%		$ 131,391	
TOTAL				$ 1,954,440	
			TOTAL CAPITAL COSTS	**$ 1,954,440**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 2,750.00	1	$ 2,750	Engineers Estimate; O & M costs for the UBMC repository are not included.
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	LS	$ 50,140.95	1	$ 50,141	Engineers Estimate; O & M costs for the UBMC repository are not included.
			Subtotal	$ 52,891	
30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS				**$106,742**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) **$2,061,182** Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 1 COSTS													
REMOVAL AND OFF-SITE DISPOSAL	**Upper Anaconda Mine (EU 1A) Waste Area**	**Upper Anaconda Mine (EU 1B) Waste Piles**	**Capital Mine (EU 3) Waste Area**	**Carbonate Mine (EU 4) Waste Area**	**Edith Mine (EU 5) Waste Area**	**Consolation Mine (EU 6) Waste Area**	**Mary P Mine (EU 7) Waste Pile**	**Mike Horse Mine (EU 8) Waste Area**	**Paymaster Mine (EU 9A) Waste Area - Surface**	**Paymaster Mine (EU 9B) Waste Area - Subsurface**	**No. 3 Tunnel Mine (EU 10) Waste Area**		**TOTAL**
Construct Off-site Repository	$ 109,130	$ 35,556	$ 12,274	$ 81,150	$ 31,532	$ 47,442	$ 7,166	$ 191,271	$ 8,724	$ 38,471	$ 22,104		$ 584,818
Improve/Construct Access Roads	$ 36,000	$ 4,500	$ 90,000	$ 3,600	$ 5,400	$ 31,500	$ -	$ 9,000	$ 900	$ -	$ -		$ 180,900
Excavate, Load, Haul and Place Waste in Repository	$ 161,734	$ 52,695	$ 18,191	$ 120,267	$ 46,731	$ 70,311	$ 10,620	$ 283,471	$ 12,930	$ 57,015	$ 32,759		$ 866,724
Load, Haul, Place Vegetative Cover	$ 40,434	$ 8,783	$ 4,548	$ 30,067	$ 11,683	$ 17,578	$ 1,770	$ 70,868	$ 3,233	$ 7,127	$ 8,190		$ 204,278
Seed, Fertilize, Mulch	$ 6,683	$ 1,452	$ 752	$ 4,970	$ 1,931	$ 2,905	$ 293	$ 11,714	$ 534	$ 1,178	$ 1,354		$ 33,765
Reclaim Cover Soil Borrow Area	$ 2,506	$ 544	$ 282	$ 1,864	$ 724	$ 1,090	$ 110	$ 4,393	$ 200	$ 442	$ 508		$ 12,662
Subtotal	$ 356,487	$ 103,529	$ 126,047	$ 241,917	$ 98,001	$ 170,825	$ 19,958	$ 570,717	$ 26,522	$ 104,232	$ 64,914		$ 1,883,147
Mob/Demob (10%)	$ 35,649	$ 10,353	$ 12,605	$ 24,192	$ 9,800	$ 17,083	$ 1,996	$ 57,072	$ 2,652	$ 10,423	$ 6,491		$ 188,315
Subtotal	$ 392,136	$ 113,882	$ 138,651	$ 266,108	$ 107,801	$ 187,908	$ 21,954	$ 627,788	$ 29,174	$ 114,655	$ 71,405		$ 2,071,462
Contingencies (15%)	$ 58,820	$ 17,082	$ 20,798	$ 39,916	$ 16,170	$ 28,186	$ 3,293	$ 94,168	$ 4,376	$ 17,198	$ 10,711		$ 310,719
Subtotal	$ 450,956	$ 130,964	$ 159,449	$ 306,025	$ 123,971	$ 216,094	$ 25,247	$ 721,957	$ 33,550	$ 131,854	$ 82,116		$ 2,382,181
Project Management (5%)	$ 22,548	$ 6,548	$ 7,972	$ 15,301	$ 6,199	$ 10,805	$ 1,262	$ 36,098	$ 1,677	$ 6,593	$ 4,106		$ 119,109
Engineering (6%)	$ 27,057	$ 7,858	$ 9,567	$ 18,361	$ 7,438	$ 12,966	$ 1,515	$ 43,317	$ 2,013	$ 7,911	$ 4,927		$ 142,931
Construction Administration (8%)	$ 36,076	$ 10,477	$ 12,756	$ 24,482	$ 9,918	$ 17,288	$ 2,020	$ 57,757	$ 2,684	$ 10,548	$ 6,569		$ 190,574
Total, Capital Cost	$ 536,638	$ 155,848	$ 189,744	$ 364,169	$ 147,525	$ 257,152	$ 30,044	$ 859,128	$ 39,924	$ 156,906	$ 97,718		$ 2,834,796
Operations and Maintenance (O & M)													
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250		$ 2,750
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	$ 9,925	$ 2,156	$ 1,116	$ 7,380	$ 2,868	$ 4,315	$ 434	$ 17,395	$ 793	$ 1,749	$ 2,010		$ 50,141
Off-site Repository O & M and Repairs, Years 1-30	$ 933	$ 304	$ 105	$ 694	$ 270	$ 406	$ 61	$ 1,635	$ 75	$ 329	$ 189		$ 5,000
Total, 30-yr Present Worth, O & M (3%)	$ 33,643	$ 13,129	$ 8,133	$ 26,274	$ 13,205	$ 17,396	$ 6,559	$ 55,278	$ 7,198	$ 13,190	$ 10,722		$ 204,727
TOTAL CAPITAL COST + O & M	$ 570,281	$ 168,977	$ 197,877	$ 390,443	$ 160,730	$ 274,547	$ 36,603	$ 914,407	$ 47,122	$ 170,096	$ 108,440		$ 3,039,523
TOTAL EA1 REMOVAL AND OFF-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O & M													**$ 3,039,523**

EA1 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 188,314.72	1	$ 188,315	10% of construction cost
Construct Off-site Repository - Total	CY	$ 10.12	57,781.6	$ 584,818	State Section 18*
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 10.12	10,782.3	$ 109,130	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 10.12	3,513.0	$ 35,556	
Capital Mine (EU 3) Waste Area	CY	$ 10.12	1,212.7	$ 12,274	
Carbonate Mine (EU 4) Waste Area	CY	$ 10.12	8,017.8	$ 81,150	
Edith Mine (EU 5) Mine Waste	CY	$ 10.12	3,115.4	$ 31,532	
Consolation Mine (EU 6) Waste Area	CY	$ 10.12	4,687.4	$ 47,442	
Mary P Mine (EU 7) Waste Pile	CY	$ 10.12	708.0	$ 7,166	
Mike Horse Mine (EU 8) Waste Area	CY	$ 10.12	18,898.1	$ 191,271	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 10.12	862.0	$ 8,724	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 10.12	3,801.0	$ 38,471	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 10.12	2,183.9	$ 22,104	
Improve/Construct Access Roads - Total	LF	$ 18.00	10,050	$ 180,900	Includes Clear/Grub/Log, Reclamation
Upper Anaconda Mine (EU 1A) Waste Area	LF	$ 18.00	2,000	$ 36,000	
Upper Anaconda Mine (EU 1B) Waste Piles	LF	$ 18.00	250	$ 4,500	
Capital Mine (EU 3) Waste Area	LF	$ 18.00	5,000	$ 90,000	
Carbonate Mine (EU 4) Waste Area	LF	$ 18.00	200	$ 3,600	
Edith Mine (EU 5) Mine Waste	LF	$ 18.00	300	$ 5,400	
Consolation Mine (EU 6) Waste Area	LF	$ 18.00	1,750	$ 31,500	
Mary P Mine (EU 7) Waste Pile	LF	$ 18.00	0	$ -	
Mike Horse Mine (EU 8) Waste Area	LF	$ 18.00	500	$ 9,000	
Paymaster Mine (EU 9A) Waste Area - Surface	LF	$ 18.00	50	$ 900	
Paymaster Mine (EU 9B) Waste Area - Subsurface	LF	$ 18.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	LF	$ 18.00	0	$ -	
Excavate, Load, Haul and Place Waste in Repository - Total	CY	$ 15.00	57,782	$ 866,724	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 15.00	10,782	$ 161,734	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 15.00	3,513	$ 52,695	
Capital Mine (EU 3) Waste Area	CY	$ 15.00	1,213	$ 18,191	
Carbonate Mine (EU 4) Waste Area	CY	$ 15.00	8,018	$ 120,267	
Edith Mine (EU 5) Mine Waste	CY	$ 15.00	3,115	$ 46,731	
Consolation Mine (EU 6) Waste Area	CY	$ 15.00	4,687	$ 70,311	
Mary P Mine (EU 7) Waste Pile	CY	$ 15.00	708	$ 10,620	
Mike Horse Mine (EU 8) Waste Area	CY	$ 15.00	18,898	$ 283,471	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 15.00	862	$ 12,930	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 15.00	3,801	$ 57,015	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 15.00	2,184	$ 32,759	
Load, Haul, Place Vegetative Cover - Total	CY	$ 15.00	13,619	$ 204,278	6 inch cover imported over removal areas
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 15.00	2,696	$ 40,434	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 15.00	586	$ 8,783	
Capital Mine (EU 3) Waste Area	CY	$ 15.00	303	$ 4,548	
Carbonate Mine (EU 4) Waste Area	CY	$ 15.00	2,004	$ 30,067	
Edith Mine (EU 5) Mine Waste	CY	$ 15.00	779	$ 11,683	
Consolation Mine (EU 6) Waste Area	CY	$ 15.00	1,172	$ 17,578	
Mary P Mine (EU 7) Waste Pile	CY	$ 15.00	118	$ 1,770	
Mike Horse Mine (EU 8) Waste Area	CY	$ 15.00	4,725	$ 70,868	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 15.00	216	$ 3,233	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 15.00	475	$ 7,127	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 15.00	546	$ 8,190	

EA1 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 2,000.00	16.9	$ 33,765	Based on Bald Butte
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 2,000.00	3.3	$ 6,683	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 2,000.00	0.7	$ 1,452	
Capital Mine (EU 3) Waste Area	AC	$ 2,000.00	0.4	$ 752	
Carbonate Mine (EU 4) Waste Area	AC	$ 2,000.00	2.5	$ 4,970	
Edith Mine (EU 5) Mine Waste	AC	$ 2,000.00	1.0	$ 1,931	
Consolation Mine (EU 6) Waste Area	AC	$ 2,000.00	1.5	$ 2,905	
Mary P Mine (EU 7) Waste Pile	AC	$ 2,000.00	0.1	$ 293	
Mike Horse Mine (EU 8) Waste Area	AC	$ 2,000.00	5.9	$ 11,714	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 2,000.00	0.3	$ 534	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 2,000.00	0.6	$ 1,178	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 2,000.00	0.7	$ 1,354	
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500.00	2.8	$ 12,662	Based on Bald Butte
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 4,500.00	0.6	$ 2,506	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 4,500.00	0.1	$ 544	
Capital Mine (EU 3) Waste Area	AC	$ 4,500.00	0.1	$ 282	
Carbonate Mine (EU 4) Waste Area	AC	$ 4,500.00	0.4	$ 1,864	
Edith Mine (EU 5) Mine Waste	AC	$ 4,500.00	0.2	$ 724	
Consolation Mine (EU 6) Waste Area	AC	$ 4,500.00	0.2	$ 1,090	
Mary P Mine (EU 7) Waste Pile	AC	$ 4,500.00	0.0	$ 110	
Mike Horse Mine (EU 8) Waste Area	AC	$ 4,500.00	1.0	$ 4,393	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 4,500.00	0.0	$ 200	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 4,500.00	0.1	$ 442	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 4,500.00	0.1	$ 508	
			Subtotal	$ 2,071,462	
Contingencies		15%		$ 310,719	
			Subtotal	$ 2,382,181	
Project Management		5%		$ 119,109	
Engineering		6%		$ 142,931	
Construction Management		8%		$ 190,574	
TOTAL				$ 2,834,796	
			TOTAL CAPITAL COSTS	**$ 2,834,796**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 2,750.00	1	$ 2,750	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	LS	$ 50,140.95	1	$ 50,141	Engineers Estimate
Off-site Repository O & M and Repairs, Years 1-30	LS	$ 5,000.00	1	$ 5,000	Engineers Estimate
			Subtotal	$ 57,891	
30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS				**$ 204,744**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COSTS) $ 3,039,540 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

* From the Repository Siting Study for UBMC - State Section 18 Site estimate was $15,034,436 for a 1,000,000 cy repository and includes wastes removed under the EE/CA actions. The total estimated cost included hauling and placement of waste. Construction costs for the repository were $4,048,472. For purposes of this feasibility study, estimated costs from the siting study are scaled to a 400,000 cy repository for a repository construction cost of $10.12/cy.

EA 1 COSTS													
IN-SITU NEUTRALIZATION WITH LIME	**Upper Anaconda Mine (EU 1A) Waste Area**	**Upper Anaconda Mine (EU 1B) Waste Piles**	**Capital Mine (EU 3) Waste Area**	**Carbonate Mine (EU 4) Waste Area**	**Edith Mine (EU 5) Waste Area**	**Consolation Mine (EU 6) Waste Area**	**Mary P Mine (EU 7) Waste Pile**	**Mike Horse Mine (EU 8) Waste Area**	**Paymaster Mine (EU 9A) Waste Area - Surface**	**Paymaster Mine (EU 9B) Waste Area - Subsurface**	**No. 3 Tunnel Mine (EU 10) Waste Area**		**TOTAL**
Improve/Construct Access Roads	$ 36,000	$ 4,500	$ 90,000	$ 3,600	$ 5,400	$ 31,500	$ -	$ 9,000	$ 900	$ -	$ -		$ 180,900
Re-Grade Waste Piles, Prep for Lime Treatment	$ 48,520	$ 10,539	$ 5,457	$ 36,080	$ 14,019	$ 21,093	$ 2,124	$ 85,041	$ 3,879	$ 8,552	$ 9,828		$ 245,134
Load, Haul, Incorporate Lime	$ 26,416	$ 5,738	$ 2,971	$ 19,643	$ 7,632	$ 11,484	$ 1,156	$ 46,298	$ 2,112	$ 4,656	$ 5,350		$ 133,456
Seed, Fertilize, Mulch	$ 6,683	$ 1,452	$ 752	$ 4,970	$ 1,931	$ 2,905	$ 293	$ 11,714	$ 534	$ 1,178	$ 1,354		$ 33,765
Subtotal	$ 117,619	$ 22,228	$ 99,180	$ 64,293	$ 28,983	$ 66,982	$ 3,573	$ 152,054	$ 7,425	$ 14,386	$ 16,532		$ 593,254
Mob/Demob (10%)	$ 11,762	$ 2,223	$ 9,918	$ 6,429	$ 2,898	$ 6,698	$ 357	$ 15,205	$ 743	$ 1,439	$ 1,653		$ 59,325
Subtotal	$ 129,381	$ 24,451	$ 109,098	$ 70,722	$ 31,881	$ 73,680	$ 3,930	$ 167,259	$ 8,168	$ 15,825	$ 18,185		$ 652,580
Contingencies (15%)	$ 19,407	$ 3,668	$ 16,365	$ 10,608	$ 4,782	$ 11,052	$ 590	$ 25,089	$ 1,225	$ 2,374	$ 2,728		$ 97,887
Subtotal	$ 148,788	$ 28,119	$ 125,463	$ 81,330	$ 36,663	$ 84,733	$ 4,520	$ 192,348	$ 9,393	$ 18,199	$ 20,913		$ 750,467
Project Management (5%)	$ 7,439	$ 1,406	$ 6,273	$ 4,067	$ 1,833	$ 4,237	$ 226	$ 9,617	$ 470	$ 910	$ 1,046		$ 37,523
Engineering (6%)	$ 8,927	$ 1,687	$ 7,528	$ 4,880	$ 2,200	$ 5,084	$ 271	$ 11,541	$ 564	$ 1,092	$ 1,255		$ 45,028
Construction Administration (8%)	$ 11,903	$ 2,250	$ 10,037	$ 6,506	$ 2,933	$ 6,779	$ 362	$ 15,388	$ 751	$ 1,456	$ 1,673		$ 60,037
Total, Capital Cost	$ 177,058	$ 33,461	$ 149,301	$ 96,783	$ 43,629	$ 100,832	$ 5,378	$ 228,894	$ 11,177	$ 21,656	$ 24,886		$ 893,056
Operations and Maintenance (O & M)													
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250		$ 2,750
Periodic Repairs - Years 15 and 30 (1/3rd remedial cost lime, reveg)	$ 11,033	$ 2,396	$ 1,241	$ 8,204	$ 3,188	$ 4,796	$ 483	$ 19,337	$ 882	$ 1,945	$ 2,235		$ 55,740
Total, 30-yr Present Worth, O & M (3%)	$ 16,523	$ 7,425	$ 6,207	$ 13,543	$ 8,259	$ 9,953	$ 5,409	$ 25,272	$ 5,829	$ 6,949	$ 7,254		$ 112,624
TOTAL CAPITAL COST + O & M	$ 193,581	$ 40,886	$ 155,508	$ 110,326	$ 51,888	$ 110,785	$ 10,787	$ 254,166	$ 17,007	$ 28,605	$ 32,140		$ 1,005,680
TOTAL EA1 IN-SITU NEUTRALIZATION COSTS WITH 30-YR PRESENT WORTH O & M													**$ 1,005,680**

EA1 COST ESTIMATE DETAIL
IN-SITU NEUTRALIZATION

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 59,325.45	1	$ 59,325	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	10,050	$ 180,900	Includes Clear/Grub/Log, Reclamation
Upper Anaconda Mine (EU 1A) Waste Area	LF	$ 18.00	2,000	$ 36,000	
Upper Anaconda Mine (EU 1B) Waste Piles	LF	$ 18.00	250	$ 4,500	
Capital Mine (EU 3) Waste Area	LF	$ 18.00	5,000	$ 90,000	
Carbonate Mine (EU 4) Waste Area	LF	$ 18.00	200	$ 3,600	
Edith Mine (EU 5) Mine Waste	LF	$ 18.00	300	$ 5,400	
Consolation Mine (EU 6) Waste Area	LF	$ 18.00	1,750	$ 31,500	
Mary P Mine (EU 7) Waste Pile	LF	$ 18.00	0	$ -	
Mike Horse Mine (EU 8) Waste Area	LF	$ 18.00	500	$ 9,000	
Paymaster Mine (EU 9A) Waste Area - Surface	LF	$ 18.00	50	$ 900	
Paymaster Mine (EU 9B) Waste Area - Subsurface	LF	$ 18.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	LF	$ 18.00	0	$ -	
Re-Grade Waste Piles, Prep for Lime Treatment - Total	SY	$ 3.00	78,435	$ 245,134	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	SY	$ 3.00	16,173	$ 48,520	
Upper Anaconda Mine (EU 1B) Waste Piles	SY	$ 3.00	3,513	$ 10,539	
Capital Mine (EU 3) Waste Area	SY	$ 3.00	1,819	$ 5,457	
Carbonate Mine (EU 4) Waste Area	SY	$ 3.00	12,027	$ 36,080	
Edith Mine (EU 5) Mine Waste	SY	$ 3.00	4,673	$ 14,019	
Consolation Mine (EU 6) Waste Area	SY	$ 3.00	7,031	$ 21,093	
Mary P Mine (EU 7) Waste Pile	SY	$ 3.00	708	$ 2,124	
Mike Horse Mine (EU 8) Waste Area	SY	$ 3.00	28,347	$ 85,041	
Paymaster Mine (EU 9A) Waste Area - Surface	SY	$ 3.00	1,293	$ 3,879	
Paymaster Mine (EU 9B) Waste Area - Subsurface	SY	$ 3.00	2,851	$ 8,552	
No. 3 Tunnel Mine (EU 10) Waste Area	SY	$ 3.00	3,276	$ 9,828	
Load, Haul, Incorporate Lime - Total	AC	$ 7,905.00	16.9	$ 133,456	Based on Stucky Ridge - Costs Increased
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 7,905.00	3.3	$ 26,416	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 7,905.00	0.7	$ 5,738	
Capital Mine (EU 3) Waste Area	AC	$ 7,905.00	0.4	$ 2,971	
Carbonate Mine (EU 4) Waste Area	AC	$ 7,905.00	2.5	$ 19,643	
Edith Mine (EU 5) Mine Waste	AC	$ 7,905.00	1.0	$ 7,632	
Consolation Mine (EU 6) Waste Area	AC	$ 7,905.00	1.5	$ 11,484	
Mary P Mine (EU 7) Waste Pile	AC	$ 7,905.00	0.1	$ 1,156	
Mike Horse Mine (EU 8) Waste Area	AC	$ 7,905.00	5.9	$ 46,298	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 7,905.00	0.3	$ 2,112	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 7,905.00	0.6	$ 4,656	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 7,905.00	0.7	$ 5,350	

EA1 COST ESTIMATE DETAIL
IN-SITU NEUTRALIZATION

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 2,000.00	16.9	$ 33,765	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 2,000.00	3.3	$ 6,683	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 2,000.00	0.7	$ 1,452	
Capital Mine (EU 3) Waste Area	AC	$ 2,000.00	0.4	$ 752	
Carbonate Mine (EU 4) Waste Area	AC	$ 2,000.00	2.5	$ 4,970	
Edith Mine (EU 5) Mine Waste	AC	$ 2,000.00	1.0	$ 1,931	
Consolation Mine (EU 6) Waste Area	AC	$ 2,000.00	1.5	$ 2,905	
Mary P Mine (EU 7) Waste Pile	AC	$ 2,000.00	0.1	$ 293	
Mike Horse Mine (EU 8) Waste Area	AC	$ 2,000.00	5.9	$ 11,714	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 2,000.00	0.3	$ 534	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 2,000.00	0.6	$ 1,178	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 2,000.00	0.7	$ 1,354	
			Subtotal	$ 652,580	
Contingencies		15%		$ 97,886.99	
			Subtotal	$ 750,467	
Project Management		5%		$ 37,523	
Engineering		6%		$ 45,028	
Construction Management		8%		$ 60,037	
TOTAL				$ 893,056	
			TOTAL CAPITAL COSTS	**$ 893,056**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 2,750.00	1	$ 2,750	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/3rd remedial cost, lime, reveg)	LS	$ 55,740.31	1	$ 55,740	Engineers Estimate
			Subtotal	$ 58,490	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 112,643**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COSTS) $ 1,005,699 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 1 COSTS													
EX-SITU NEUTRALIZATION WITH LIME	**Upper Anaconda Mine (EU 1A) Waste Area**	**Upper Anaconda Mine (EU 1B) Waste Piles**	**Capital Mine (EU 3) Waste Area**	**Carbonate Mine (EU 4) Waste Area**	**Edith Mine (EU 5) Waste Area**	**Consolation Mine (EU 6) Waste Area**	**Mary P Mine (EU 7) Waste Pile**	**Mike Horse Mine (EU 8) Waste Area**	**Paymaster Mine (EU 9A) Waste Area - Surface**	**Paymaster Mine (EU 9B) Waste Area - Subsurface**	**No. 3 Tunnel Mine (EU 10) Waste Area**		**TOTAL**
Improve/Construct Access Roads	$ 36,000	$ 4,500	$ 90,000	$ 3,600	$ 5,400	$ 31,500	$ -	$ 9,000	$ 900	$ -	$ -		$ 180,900
Excavate, Load, Haul and Place Waste in Mixing Area	$ 129,388	$ 42,156	$ 14,553	$ 96,214	$ 37,385	$ 56,249	$ 8,496	$ 226,777	$ 10,344	$ 45,612	$ 26,207		$ 693,379
Load, Haul, Incorporate Lime	$ 26,416	$ 5,738	$ 2,971	$ 19,643	$ 7,632	$ 11,484	$ 1,156	$ 46,298	$ 2,112	$ 4,656	$ 5,350		$ 133,456
Load, Haul and Replace Treated Waste	$ 71,163	$ 23,186	$ 8,004	$ 52,917	$ 20,562	$ 30,937	$ 4,673	$ 124,727	$ 5,689	$ 25,087	$ 14,414		$ 381,359
Seed, Fertilize, Mulch	$ 13,366	$ 2,903	$ 1,503	$ 9,939	$ 3,862	$ 5,811	$ 585	$ 23,427	$ 1,069	$ 2,356	$ 2,707		$ 67,530
Subtotal	$ 276,333	$ 78,483	$ 117,031	$ 182,313	$ 74,841	$ 135,980	$ 14,910	$ 430,230	$ 20,114	$ 77,711	$ 48,679		$ 1,456,624
Mob/Demob (10%)	$ 27,633	$ 7,848	$ 11,703	$ 18,231	$ 7,484	$ 13,598	$ 1,491	$ 43,023	$ 2,011	$ 7,771	$ 4,868		$ 145,662
Subtotal	$ 303,966	$ 86,331	$ 128,734	$ 200,545	$ 82,325	$ 149,578	$ 16,401	$ 473,253	$ 22,125	$ 85,482	$ 53,546		$ 1,602,286
Contingencies (15%)	$ 45,595	$ 12,950	$ 19,310	$ 30,082	$ 12,349	$ 22,437	$ 2,460	$ 70,988	$ 3,319	$ 12,822	$ 8,032		$ 240,343
Subtotal	$ 349,561	$ 99,281	$ 148,044	$ 230,626	$ 94,674	$ 172,014	$ 18,861	$ 544,241	$ 25,444	$ 98,304	$ 61,578		$ 1,842,629
Project Management (5%)	$ 17,478	$ 4,964	$ 7,402	$ 11,531	$ 4,734	$ 8,601	$ 943	$ 27,212	$ 1,272	$ 4,915	$ 3,079		$ 92,131
Engineering (6%)	$ 20,974	$ 5,957	$ 8,883	$ 13,838	$ 5,680	$ 10,321	$ 1,132	$ 32,654	$ 1,527	$ 5,898	$ 3,695		$ 110,558
Construction Administration (8%)	$ 27,965	$ 7,942	$ 11,844	$ 18,450	$ 7,574	$ 13,761	$ 1,509	$ 43,539	$ 2,035	$ 7,864	$ 4,926		$ 147,410
Total, Capital Cost	$ 415,977	$ 118,144	$ 176,173	$ 274,445	$ 112,662	$ 204,697	$ 22,445	$ 647,647	$ 30,278	$ 116,982	$ 73,278		$ 2,192,729
Operations and Maintenance (O & M)													
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250		$ 2,750
Periodic Repairs - Years 15 and 30 (1/3rd remedial cost lime, reveg)	$ 13,261	$ 2,880	$ 1,491	$ 9,861	$ 3,831	$ 5,765	$ 580	$ 23,242	$ 1,060	$ 2,337	$ 2,686		$ 66,995
Total, 30-yr Present Worth, O & M (3%)	$ 18,870	$ 7,935	$ 6,471	$ 15,288	$ 8,937	$ 10,973	$ 5,512	$ 29,386	$ 6,017	$ 7,363	$ 7,730		$ 124,481
TOTAL CAPITAL COST + O & M	$ 434,848	$ 126,079	$ 182,644	$ 289,734	$ 121,599	$ 215,670	$ 27,957	$ 677,033	$ 36,295	$ 124,344	$ 81,008		$ 2,317,210
TOTAL EA1 EX-SITU NEUTRALIZATION COSTS WITH 30-YR PRESENT WORTH O & M													**$ 2,317,210**

EA1 COST ESTIMATE DETAIL
EX-SITU NEUTRALIZATION

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 145,662.40	1	$ 145,662	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	10,050	$ 180,900	Includes Clear/Grub/Log, Reclamation
Upper Anaconda Mine (EU 1A) Waste Area	LF	$ 18.00	2,000	$ 36,000	
Upper Anaconda Mine (EU 1B) Waste Piles	LF	$ 18.00	250	$ 4,500	
Capital Mine (EU 3) Waste Area	LF	$ 18.00	5,000	$ 90,000	
Carbonate Mine (EU 4) Waste Area	LF	$ 18.00	200	$ 3,600	
Edith Mine (EU 5) Mine Waste	LF	$ 18.00	300	$ 5,400	
Consolation Mine (EU 6) Waste Area	LF	$ 18.00	1,750	$ 31,500	
Mary P Mine (EU 7) Waste Pile	LF	$ 18.00	0	$ -	
Mike Horse Mine (EU 8) Waste Area	LF	$ 18.00	500	$ 9,000	
Paymaster Mine (EU 9A) Waste Area - Surface	LF	$ 18.00	50	$ 900	
Paymaster Mine (EU 9B) Waste Area - Subsurface	LF	$ 18.00	0	$ -	
No. 3 Tunnel Mine (EU 10) Waste Area	LF	$ 18.00	0	$ -	
Excavate, Load, Haul and Place Waste in Mixing Area - Total	CY	$ 12.00	57,782	$ 693,379	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 12.00	10,782	$ 129,388	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 12.00	3,513	$ 42,156	
Capital Mine (EU 3) Waste Area	CY	$ 12.00	1,213	$ 14,553	
Carbonate Mine (EU 4) Waste Area	CY	$ 12.00	8,018	$ 96,214	
Edith Mine (EU 5) Mine Waste	CY	$ 12.00	3,115	$ 37,385	
Consolation Mine (EU 6) Waste Area	CY	$ 12.00	4,687	$ 56,249	
Mary P Mine (EU 7) Waste Pile	CY	$ 12.00	708	$ 8,496	
Mike Horse Mine (EU 8) Waste Area	CY	$ 12.00	18,898	$ 226,777	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 12.00	862	$ 10,344	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 12.00	3,801	$ 45,612	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 12.00	2,184	$ 26,207	
Load, Haul, Incorporate Lime - Total	AC	$ 7,905.00	16.9	$ 133,456	Based on Stucky Ridge - Costs Increased
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 7,905.00	3.3	$ 26,416	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 7,905.00	0.7	$ 5,738	
Capital Mine (EU 3) Waste Area	AC	$ 7,905.00	0.4	$ 2,971	
Carbonate Mine (EU 4) Waste Area	AC	$ 7,905.00	2.5	$ 19,643	
Edith Mine (EU 5) Mine Waste	AC	$ 7,905.00	1.0	$ 7,632	
Consolation Mine (EU 6) Waste Area	AC	$ 7,905.00	1.5	$ 11,484	
Mary P Mine (EU 7) Waste Pile	AC	$ 7,905.00	0.1	$ 1,156	
Mike Horse Mine (EU 8) Waste Area	AC	$ 7,905.00	5.9	$ 46,298	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 7,905.00	0.3	$ 2,112	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 7,905.00	0.6	$ 4,656	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 7,905.00	0.7	$ 5,350	
Load, Haul and Replace Treated Waste - Total	CY	$ 6.00	63,560	$ 381,359	Engineer Estimate
Upper Anaconda Mine (EU 1A) Waste Area	CY	$ 6.00	11,861	$ 71,163	
Upper Anaconda Mine (EU 1B) Waste Piles	CY	$ 6.00	3,864	$ 23,186	
Capital Mine (EU 3) Waste Area	CY	$ 6.00	1,334	$ 8,004	
Carbonate Mine (EU 4) Waste Area	CY	$ 6.00	8,820	$ 52,917	
Edith Mine (EU 5) Mine Waste	CY	$ 6.00	3,427	$ 20,562	
Consolation Mine (EU 6) Waste Area	CY	$ 6.00	5,156	$ 30,937	
Mary P Mine (EU 7) Waste Pile	CY	$ 6.00	779	$ 4,673	
Mike Horse Mine (EU 8) Waste Area	CY	$ 6.00	20,788	$ 124,727	
Paymaster Mine (EU 9A) Waste Area - Surface	CY	$ 6.00	948	$ 5,689	
Paymaster Mine (EU 9B) Waste Area - Subsurface	CY	$ 6.00	4,181	$ 25,087	
No. 3 Tunnel Mine (EU 10) Waste Area	CY	$ 6.00	2,402	$ 14,414	

EA1 COST ESTIMATE DETAIL
EX-SITU NEUTRALIZATION

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 2,000.00	33.8	$ 67,530	Engineer Estimate - area doubled to account for mixing area
Upper Anaconda Mine (EU 1A) Waste Area	AC	$ 2,000.00	6.7	$ 13,366	
Upper Anaconda Mine (EU 1B) Waste Piles	AC	$ 2,000.00	1.5	$ 2,903	
Capital Mine (EU 3) Waste Area	AC	$ 2,000.00	0.8	$ 1,503	
Carbonate Mine (EU 4) Waste Area	AC	$ 2,000.00	5.0	$ 9,939	
Edith Mine (EU 5) Mine Waste	AC	$ 2,000.00	1.9	$ 3,862	
Consolation Mine (EU 6) Waste Area	AC	$ 2,000.00	2.9	$ 5,811	
Mary P Mine (EU 7) Waste Pile	AC	$ 2,000.00	0.3	$ 585	
Mike Horse Mine (EU 8) Waste Area	AC	$ 2,000.00	11.7	$ 23,427	
Paymaster Mine (EU 9A) Waste Area - Surface	AC	$ 2,000.00	0.5	$ 1,069	
Paymaster Mine (EU 9B) Waste Area - Subsurface	AC	$ 2,000.00	1.2	$ 2,356	
No. 3 Tunnel Mine (EU 10) Waste Area	AC	$ 2,000.00	1.4	$ 2,707	
			Subtotal	$ 1,602,286	
Contingencies		15%		$ 240,343	
			Subtotal	$ 1,842,629	
Project Management		5%		$ 92,131	
Engineering		6%		$ 110,558	
Construction Management		8%		$ 147,410	
TOTAL				$ 2,192,729	
			TOTAL CAPITAL COSTS	**$ 2,192,729**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 2,750.00	1	$ 2,750	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/3rd remedial cost lime, reveg)	LS	$ 66,995.29	1	$ 66,995	Engineers Estimate
			Subtotal	$ 69,745	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 124,504**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COSTS) $ 2,317,233 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 1 QUANTITY ESTIMATES					
SITE	**WASTE**		**ACCESS - DIST. TO ROADS**		
	AREA	**VOLUME**	**LENGTH**	**IMPROVE?**	**FENCING**
	(sf)	**(cy)**	**(ft)**		**(ft)**
EU-1A Upper Anaconda	145,561	10,782	2,000	YES	1,670
EU 1B Upper Anaconda	31,617	3,513	250	YES	780
EU 3 Capital Mine	16,372	1,213	5,000	YES	560
EU 4 Carbonate	108,240	8,018	200	YES	1,440
EU-5 Edith Mine	42,058	3,115	300	YES	900
EU-6 Consolation	63,280	4,687	1,750	SLIGHT	1,100
EU 7 Mary P Mine	6,372	708	0	YES	350
EU 8 MH Waste Area	255,124	18,898	500	YES	2,210
EU-9A Paymaster	11,637	862	50	SLIGHT	470
EU-9B Paymaster Subsurface	25,657	3,801	0	NO	700
EU-10 No.3 Tunnel	29,483	2,184	0	NO	750
TOTALS	735,401	57,782	10,050		10,930

Improve/Reconstruct Access Roads

	ft	$/acre	$/sf	$/lf	
width	14				
Clear & Grub		5175	0.1188017	2.00	
Grading/Earthwork				11	Bald Butte
Reclaim				5	
				18.00	

Retention pond

FLOW	0.1	GPM	
VOLUME	52560	CF/YEAR	
AREA	17520	SF	ASSUMING 3' DEPTH
DIMENSIONS			
LENGTH	199		
WIDTH	88		
EXCAVATION VOL	1,298	CY	CUT/FILL BALANCE
ROCK	10	CY	EMERGENCY OVERFLOW

COST		
EXCAV	$12	PER CY
ROCK	$35	PER CY
REVEG	$2,500	PER AC

PER POND $17,130.00

TABLE C.4 - CONCEPTUAL COST ESTIMATE STATE SECTION 18 SITE

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Prepare Repository					
Strip and Stockpile Cover Soil and Subsoil	CY	$2.25	65,000	$ 146,250.00	Estimated 2-foot average is available at this site
Prepare Subgrade	SY	$1.00	96,800	$ 96,800.00	Estimated 20 acres
Special Excavation	CY	$9.00	0	$ -	Not required at this site
Load, Haul, Place, and Grade Structural Berm	CY	$25.00	0	$ -	Not required at this site
Install Geocushion	SY	$3.00	0	$ -	Not required at this site
Install Geomembrane	SY	$6.00	0	$ -	Not required at this site
Install Geocomposite Drainage Layer	SY	$4.00	0	$ -	Not required at this site
Install Leachate Collection System	LS	$37,000.00	0	$ -	Not required at this site
Place Tailings and Waste Rock					
Place and Compact Tailings In Repository	CY	$2.25	1,000,000	$ 2,250,000.00	Based on Bald Butte Bid Tabs
Close Repository					
Install Geomembrane Liner	SY	$6.00	96,800	$ 580,800.00	Based on Bald Butte Bid Tabs
Install Geocomposite Cap Drainage Layer	SY	$4.00	96,800	$ 387,200.00	Based on Bald Butte Bid Tabs
Replace Stockpiled Cover Soil	CY	$1.75	65,000	$ 113,750.00	Stockpiled Portion
Place Imported Cover Soil	CY	$1.20	0	$ -	Import From Nora Creek Site
Amend Cover Soil	TON	$350.00	487.5	$ 170,625	Amendment at 3% of top 6 inches of cover soil
Fertilize and Seed	AC	$800.00	20	$ 16,000	Based on Bald Butte Bid Tabs
Haul Roads					
Road Improvement	LF	$6.00	12,000	$ 72,000	Existing road surface upgrade and maintenance
New Road Construction	LF	$10.00	0	$ -	
Misc. Road Improvement	LS	$20,000.00	1	$ 20,000	Miscellaneous small culverts and highway access
Tailings and Borrow Material Haul					
Haul with Back Haul	CY	$ 6.57	400,000	$ 2,627,358	Assuming 400,000 cy of veg borrow required for reclamation
Haul without Back Haul	CY	$ 10.18	600,000	$ 6,108,607	
Back Haul Veg Borrow	CY	$ 3.61	400,000	$ 1,445,047	Assuming 400,000 cy of veg borrow required for reclamation
Excavate Borrow Materials	CY	$ 2.50	400,000	$ 1,000,000	Assuming 400,000 cy of veg borrow required for reclamation
Off-Site Borrow Area Development					
New Road Construction	LF	$10.00	0	$ -	Access to Nora Creek Site
Strip and Stockpile Cover Soil	CY	$2.25	0	$ -	Strip 2 feet from borrow area
Excavate Borrow Materials	CY	$2.50	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Haul Borrow Material	CY	$3.46	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Replace Stockpiled Cover Soil	CY	$1.25	0	$ -	Replace 2 inches of native cover
Fertilize and Seed	Ac	$800.00	0	$ -	Native seed and fertilizer
Other Costs					
Land Acquisition	AC	$1,200.00	0	$ -	Not required at this site
TOTAL				**$ 15,034,436**	

* Cost Estimate taken from UBMC Repository Siting Study (Pioneer, 2011)

$	4,048,472	TOTAL REPOSITORY COST, LESS COST TO HAUL AND PLACE WASTE
$	4.05	PER CUBIC YARD (For 1,000,000 cy repository), LESS COST TO HAUL/PLACE WASTE
	2.50	SCALE FACTOR FOR SMALLER REPOSITORY (1,000,000 cy vs. 400,000 cy) ASSUMING ALL WASTE FROM EA1, EA3, EA4, AND EA5.
$	**10.12**	**PER CUBIC YARD (For 400,000 cy repository), LESS COST TO HAUL/PLACE WASTE**

EVALUATION AREA	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS							
EA 2					GROUNDWATER						
Groundwater				No Action	Monitored Natural Attenuation	ENGINEERING CONTROLS			TREATMENT		
									Active		Passive
	ICs	Access Restrictions	Long-term Monitoring and Maintenance			Containment (Retention Pond)	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Anaconda Mine (EU 1) Adit Discharge	$0	$0	$0	$0	$400,379	N/A	N/A	N/A	$337,119	$337,119	$1,446,928
Carbonate Mine (EU 4) Groundwater	$5,000	$0	$0	$0	$400,379	N/A	$464,514	N/A	$3,733,973	$3,733,973	$1,830,977
Mike Horse Mine (EU 8) Adit Discharge and Seeps	$0	$0	$0	$0	$400,379	N/A	N/A	N/A	$4,433,677	$4,433,677	$2,992,540
Paymaster Gulch Groundwater Aquifers	$5,000	$0	$0	$0	$400,379	N/A	N/A	N/A	$3,547,147	$3,547,147	$1,556,582
Upper Mike Horse Mine Bedrock Groundwater Aquifer	$5,000	$0	$0	$0	$400,379	N/A	N/A	N/A	$5,404,334	$5,404,334	N/A
Capital Mine Adit Plug	$0	$0	$0	$0	$0	N/A	N/A	$10,124	N/A	N/A	N/A
TOTAL COSTS	**$15,000**	**$0**	**$0**	**$0**	**$2,001,895**	**$0**	**$464,514**	**$10,124**	**$17,456,250**	**$17,456,250**	**$7,827,027**

Note: Given the current design of the WTP, it is difficult to segregate chemical treatment costs from physical/mechanical treatment costs; therefore, for cost estimation purposes, the overall costs were allocated equally.

EA 2 COSTS								
MONITORED NATURAL ATTENUATION	**Anaconda Mine (EU 1) Adit Discharge**	**Carbonate Mine (EU 4) Groundwater**	**Mike Horse Mine (EU 8) Adit Discharge and Seeps**	**Paymaster Gulch Groundwater Aquifers**	**Upper Mike Horse Mine Bedrock Groundwater Aquifer**	**Capital Mine Adit Plug**		**TOTAL**
Additional Monitoring Well Installation	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ -		$ 50,000
Subtotal	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ -		$ 50,000
Mob/Demob (10%)	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ -		$ 5,000
Subtotal	$ 11,000	$ 11,000	$ 11,000	$ 11,000	$ 11,000	$ -		$ 55,000
Contingencies (15%)	$ 1,650	$ 1,650	$ 1,650	$ 1,650	$ 1,650	$ -		$ 8,250
Subtotal	$ 12,650	$ 12,650	$ 12,650	$ 12,650	$ 12,650	$ -		$ 63,250
Project Management (5%)	$ 633	$ 633	$ 633	$ 633	$ 633	$ -		$ 3,163
Engineering (6%)	$ 759	$ 759	$ 759	$ 759	$ 759	$ -		$ 3,795
Construction Administration (8%)	$ 1,012	$ 1,012	$ 1,012	$ 1,012	$ 1,012	$ -		$ 5,060
Total, Capital Cost	$ 15,054	$ 15,054	$ 15,054	$ 15,054	$ 15,054	$ -		$ 75,268
Operations and Maintenance (O & M)								
Semiannual Monitoring -Existing Wells, Sampling, Analysis, Report - Years 1-10	$ 27,000	$ 27,000	$ 27,000	$ 27,000	$ 27,000	$ -		$ 135,000
Annual Monitoring, Years 11-30	$ 13,500	$ 13,500	$ 13,500	$ 13,500	$ 13,500	$ -		
Total, 30-yr Present Worth, O & M (3%)	$ 385,326	$ 385,326	$ 385,326	$ 385,326	$ 385,326	$ -		$ 1,926,628
TOTAL CAPITAL COST + O & M	$ 400,379	$ 400,379	$ 400,379	$ 400,379	$ 400,379	$ -		$ 2,001,895
TOTAL EA2 MNA COSTS WITH 30-YR PRESENT WORTH O & M								**$ 2,001,895**

EA2 COST ESTIMATE DETAIL
MONITORED NATURAL ATTENUATION

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization/Demobilization	LS	$ 5,000.00	1	$ 5,000	10% of construction cost
Well Installation	EA	$ 10,000.00	5	$ 50,000	
			Subtotal	$ 55,000	
Contingencies		15%		$ 8,250	
			Subtotal	$ 63,250	
Project Management		5%		$ 3,163	
Engineering		6%		$ 3,795	
Construction Management		8%		$ 5,060	
TOTAL				$ 75,268	
			TOTAL CAPITAL COSTS	**$ 75,268**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Semiannual Monitoring -Existing Wells, Sampling, Analysis, Report - Years 1-10	LS	$ 135,000.00	1	$ 135,000	Based on current budget, increase for add'l wells and semiannual monitoring
Annual Monitoring, Years 11-30	LS	$ 67,500.00	1	$ 67,500	
			Subtotal	$ 202,500	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 1,926,628**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COSTS) $ 2,001,895

Groundwater Monitoring	EA	$65,000.00	2	$130,000.00	Existing Annual Budget is ~$65K for GW - Double this for MNA
Analysis and Report	EA	$5,000	1	$5,000.00	
			Annual Cost	$135,000.00	

EA 2 COSTS									
HYDROLOGIC AND HYDRAULIC CONTROL		**Anaconda Mine (EU 1) Adit Discharge**	**Carbonate Mine (EU 4) Groundwater**	**Mike Horse Mine (EU 8) Adit Discharge and Seeps**	**Paymaster Gulch Groundwater Aquifers**	**Upper Mike Horse Mine Bedrock Groundwater Aquifer**	**Capital Mine Adit Plug**		**TOTAL**
Surface Water and Sediment Control		$ -	$ 9,000	$ -	$ -	$ -	$ -		$ 9,000
Install Temporary Stream Channel Diversion		$ -	$ 28,800	$ -	$ -	$ -	$ -		$ 28,800
Reconstruct Stream		$ -	$ 113,750	$ -	$ -	$ -	$ -		$ 113,750
Install Sheet Piling Cutoff Wall		$ -	$ 57,500	$ -	$ -	$ -	$ -		$ 57,500
Seed, Fertilize, Mulch		$ -	$ 4,000	$ -	$ -	$ -	$ -		$ 4,000
Subtotal		$ -	$ 213,050	$ -	$ -	$ -	$ -		$ 213,050
Mob/Demob (10%)	10%	$ -	$ 21,305	$ -	$ -	$ -	$ -		$ 21,305
Subtotal		$ -	$ 234,355	$ -	$ -	$ -	$ -		$ 234,355
Contingencies (15%)	15%	$ -	$ 35,153	$ -	$ -	$ -	$ -		$ 35,153
Subtotal		$ -	$ 269,508	$ -	$ -	$ -	$ -		$ 269,508
Project Management (5%)	5%	$ -	$ 13,475	$ -	$ -	$ -	$ -		$ 13,475
Engineering (6%)	6%	$ -	$ 16,170	$ -	$ -	$ -	$ -		$ 16,170
Construction Administration (8%)	8%	$ -	$ 21,561	$ -	$ -	$ -	$ -		$ 21,561
Total, Capital Cost		$ -	$ 320,715	$ -	$ -	$ -	$ -		$ 320,715
Operations and Maintenance (O & M)									
Channel and Reclamation Maintenance, Years 1-5		$ -	$ 15,000	$ -	$ -	$ -	$ -		$ 15,000
Channel and Reclamation Maintenance, Years 5-30		$ -	$ 5,000	$ -	$ -	$ -	$ -		$ 5,000
Total, 30-yr Present Worth, O & M (3%)	3%	$ -	$143,799	$ -	$ -	$ -	$ -		$ 143,799
TOTAL CAPITAL COST + O & M		$ -	$ 464,514	$ -	$ -	$ -	$ -		$ 464,514
TOTAL EA2 HYDROLOGIC AND HYDRAULIC CONTROL COSTS WITH 30-YR PRESENT WORTH O & M									**$ 464,514**

EA2 COST ESTIMATE DETAIL
HYDROLOGIC AND HYDRAULIC CONTROL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Carbonate Mine (EU 4) Groundwater					
Mobilization, Bonding, Insurance	LS	$ 21,305.00	1	$ 21,305	10% of construction cost
Surface Water and Sediment Control	LS	$ 9,000.00	1	$ 9,000	General Site BMP's
Install Temporary Stream Channel Diversion	LF	$ 32.00	900	$ 28,800	Based on SSTOU Bid Tabs
Reconstruct Stream	LF	$ 125.00	910	$ 113,750	Based on SSTOU Bid Tabs
Install Sheet Piling Cutoff Wall	LF	$ 250.00	230	$ 57,500	Based on McLaren estimates in 2009
Seed, Fertilize, Mulch	AC	$ 2,000.00	2	$ 4,000	Native seed and fertilizer
			Subtotal	$ 234,355	
Contingencies		15%		$ 35,153	
			Subtotal	$ 269,508	
Project Management		5%		$ 13,475	
Engineering		6%		$ 16,170	
Construction Management		8%		$ 21,561	
TOTAL				$ 320,715	
			TOTAL CAPITAL COSTS	**$ 320,715**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Channel and Reclamation Maintenance, Years 1-5	LS	$ 15,000.00	1	$ 15,000	Engineers Estimate
Channel and Reclamation Maintenance, Years 5-30	LS	$ 5,000.00	1	$ 5,000	Engineers Estimate
			Subtotal	$ 20,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 143,799**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COSTS) $ 464,514 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA2 COSTS								
INUNDATION	**Anaconda Mine (EU 1) Adit Discharge**	**Carbonate Mine (EU 4) Groundwater**	**Mike Horse Mine (EU 8) Adit Discharge and Seeps**	**Paymaster Gulch Groundwater Aquifers**	**Upper Mike Horse Mine Bedrock Groundwater Aquifer**	**Capital Mine Adit Plug**		**TOTAL**
Capital Mine Adit Plug	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Mob/Demob (10%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Contingencies (15%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Project Management (5%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Engineering (6%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Construction Administration (8%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Total, Capital Cost	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Operations and Maintenance (O & M)								
Site Inspection, Maintenance and Repairs, Year 1	$ -	$ -	$ -	$ -	$ -	$ 5,000		$ 5,000
Periodic Repairs - Years 15 and 30	$ -	$ -	$ -	$ -	$ -	$ 5,000		$ 5,000
Total, 30-yr Present Worth, O & M (3%)	$ -	$ -	$ -	$ -	$ -	$ 10,124		$ 10,124
TOTAL CAPITAL COST + O & M	$ -	$ -	$ -	$ -	$ -	$ 10,124		$ 10,124
TOTAL EA2 INUNDATION COSTS WITH 30-YR PRESENT WORTH O & M								**$ 10,124**

EA2 COST ESTIMATE DETAIL
INUNDATION

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Capital Mine Adit Plug					Already in place
			Subtotal	$ -	
Contingencies		15%		$ -	
			Subtotal	$ -	
Project Management		5%		$ -	
Engineering		6%		$ -	
Construction Management		8%		$ -	
TOTAL				$ -	
				TOTAL CAPITAL COSTS	**$ -**

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspection, Maintenance and Repairs, Year 1	LS	$ 5,000.00	1	$ 5,000	Engineers Estimate
Periodic Repairs - Years 15 and 30	LS	$ 5,000.00	1	$ 5,000	Engineers Estimate
			Subtotal	$ 10,000	
				30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 10,124**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 10,124

EA 2 COSTS								
ACTIVE TREATMENT - CHEMICAL REAGENT (ALKALINE ADDITION)	**Anaconda Mine (EU 1) Adit Discharge**	**Carbonate Mine (EU 4) Groundwater**	**Mike Horse Mine (EU 8) Adit Discharge and Seeps**	**Paymaster Gulch Groundwater Aquifers**	**Upper Mike Horse Mine Bedrock Groundwater Aquifer**	**Capital Mine Adit Plug**		**TOTAL**
Preliminary Design and Detailed Site Investigations	$ -	$ 158,000	$ -	$ 171,500	$ 277,500	$ -		$ 607,000
Construct Capture and Conveyance System	$ -	$ 719,000	$ -	$ 477,500	$ 591,500	$ -		$ 1,788,000
Expansion of WTP	$ -	$ 420,470	$ -	$ 455,060	$ 727,160	$ -		$ 1,602,690
Subtotal	$ -	$ 1,297,470	$ -	$ 1,104,060	$ 1,596,160	$ -		$ 3,997,690
Mob/Demob (10%)	$ -	$ 129,747	$ -	$ 110,406	$ 159,616	$ -		$ 399,769
Subtotal	$ -	$ 1,427,217	$ -	$ 1,214,466	$ 1,755,776	$ -		$ 4,397,459
Contingencies (15%)	$ -	$ 214,083	$ -	$ 182,170	$ 263,366	$ -		$ 659,619
Subtotal	$ -	$ 1,641,300	$ -	$ 1,396,636	$ 2,019,142	$ -		$ 5,057,078
Project Management (5%)	$ -	$ 82,065	$ -	$ 69,832	$ 100,957	$ -		$ 252,854
Engineering (6%)	$ -	$ 98,478	$ -	$ 83,798	$ 121,149	$ -		$ 303,425
Construction Administration (8%)	$ -	$ 131,304	$ -	$ 111,731	$ 161,531	$ -		$ 404,566
Total, Capital Cost	$ -	$ 1,953,146	$ -	$ 1,661,997	$ 2,402,779	$ -		$ 6,017,923
Operations and Maintenance (O & M)								
Exist WTP Annual Operational Costs	$ 16,662	$ -	$ 223,515	$ -	$ -	$ -		$ 240,178
Incremental Increase in WTP Annual Costs - Carbonate	$ -	$ 62,009	$ -	$ -	$ -	$ -		$ 62,009
Incremental Increase in WTP Annual Costs - Paymaster	$ -	$ -	$ -	$ 67,109	$ -	$ -		$ 67,109
Incremental Increase in WTP Annual Costs - UMH	$ -	$ -	$ -	$ -	$ 107,238	$ -		$ 107,238
Annual Maintenance of Pipelines and Pump Stations	$ -	$ 23,455	$ -	$ 25,384	$ 40,562			$ 89,400
Periodic Replacement of Parts and Equipment - New Collection Systems, Years 15 and 30	$ 10,000	$ 100,326	$ 50,000	$ 68,579	$ 99,295	$ -		$ 328,200
Total, 30-yr Present Worth, O & M (3%)	$ 337,119	$ 1,780,826	$ 4,433,677	$ 1,885,151	$ 3,001,555	$ -		$ 11,438,327
TOTAL CAPITAL COST + O & M	$ 337,119	$ 3,733,973	$ 4,433,677	$ 3,547,147	$ 5,404,334	$ -		$ 17,456,250
TOTAL EA2 ACTIVE TREATMENT CHEMICAL REAGENT COST WITH 30-YR PRESENT WORTH O & M								**$ 17,456,250**
Note: Given the current design of the WTP, it is difficult to segregate chemical treatment costs from physical treatment costs; therefore, for cost estimation purposes, the overall costs were allocated equally.								

EA2 COST ESTIMATE DETAIL
ACTIVE TREATMENT - CHEMICAL REAGENT (ALKALINE ADDITION)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 399,769.00	1	$ 399,769	10% of construction cost
Preliminary Design and Detailed Site Investigations					
Anaconda Mine (EU 1) Adit Discharge	LS	$ 1.00	0	$ -	Already in Place
Carbonate Mine (EU 4) Groundwater - Total				$ 158,000	
Detailed Site Characterization at Removal site	LS	$ 23,000.00	1	$ 23,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 23,000.00	1	$ 23,000	Batch & Column; Implementation and Reporting
Computer Modeling (CSM)	LS	$ 10,000.00	1	$ 10,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 17,000.00	1	$ 17,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 85,000.00	1	$ 85,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Mike Horse Mine (EU 8) Adit Discharge and Seeps	LS	$ 1.00	0	$ -	Already in Place
Paymaster Gulch Groundwater Aquifers - Total				$ 171,500	
Detailed Site Characterization	LS	$ 25,000.00	1	$ 25,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 25,000.00	1	$ 25,000	Batch & Column; Implementation and Reporting
Computer Modeling (CSM)	LS	$ 11,000.00	1	$ 11,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 18,500.00	1	$ 18,500	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 92,000.00	1	$ 92,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Upper Mike Horse Mine Bedrock Groundwater Aquifer - Total				$ 277,500	
Detailed Site Characterization	LS	$ 40,000.00	1	$ 40,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 40,000.00	1	$ 40,000	Batch & Column; Implementation and reporting
Computer Modeling (CSM)	LS	$ 17,500.00	1	$ 17,500	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 30,000.00	1	$ 30,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 150,000.00	1	$ 150,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Construct Capture and Conveyance System					
Carbonate Mine (EU 4) Groundwater - Total				$ 719,000	
Install Sheet Pile Cutoff	LF	$ 250.00	600	$ 150,000	
Construct Interception Trench	LF	$ 200.00	600	$ 120,000	600 feet x 6 feet x 120 feet
Install Extraction Wells	EA	$ 12,000.00	2	$ 24,000	$100/feet, 120 feet deep
Construct Pumping Station	LS	$ 60,000.00	1	$ 60,000	
Construct Conveyance Pipeline	LF	$ 50.00	7,300	$ 365,000	
Paymaster Gulch Groundwater Aquifers - Total				$ 477,500	
Install Sheet Pile Cutoff	LF	$ 250.00	320	$ 80,000	
Construct Interception Trench	LF	$ 200.00	320	$ 64,000	600 feet x 6 feet x 120 feet
Install Extraction Wells	EA	$ 12,000.00	2	$ 24,000	$100/feet, 120 feet deep
Construct Pumping Station	LS	$ 60,000.00	1	$ 60,000	
Construct Conveyance Pipeline	LF	$ 50.00	4,990	$ 249,500	
Upper Mike Horse Mine Bedrock Groundwater Aquifer - Total				$ 591,500	
Install Sheet Pile Cutoff	LF	$ 250.00	325	$ 81,250	
Construct Interception Trench	LF	$ 200.00	325	$ 65,000	600 feet x 6 feet x 120 feet
Install Extraction Wells	EA	$ 12,000.00	2	$ 24,000	$100/feet, 120 feet deep
Construct Pumping Station	LS	$ 60,000.00	1	$ 60,000	
Construct Conveyance Pipeline	LF	$ 50.00	7,225	$ 361,250	

EA2 COST ESTIMATE DETAIL
ACTIVE TREATMENT - CHEMICAL REAGENT (ALKALINE ADDITION)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Expansion of WTP - Total				$ 1,602,690	
Carbonate Mine (EU 4) Groundwater	LS	$ 420,470.00	1	$ 420,470	Proportion of 1/2 existing WTP, based on flow
Paymaster Gulch Groundwater Aquifers	LS	$ 455,060.00	1	$ 455,060	Proportion of 1/2 existing WTP, based on flow
Upper Mike Horse Mine Bedrock Groundwater Aquifer	LS	$ 727,160.00	1	$ 727,160	Proportion of 1/2 existing WTP, based on flow
			Subtotal	$ 4,397,459	
Contingencies		15%		$ 659,619	
			Subtotal	$ 5,057,078	
Project Management		5%		$ 252,854	
Engineering		6%		$ 303,425	
Construction Management		8%		$ 404,566	
TOTAL				$ 6,017,923	
			TOTAL CAPITAL COSTS	**$ 6,017,923**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Exist WTP Annual Operational Costs	LS	$ 240,177.50	1	$ 240,178	2013 WTP Budget - DEQ - Divided in half for using only half of the process
Incremental Increase in WTP Annual Costs - Carbonate	LS	$ 62,009.46	1	$ 62,009	Proportion based on flow rate
Incremental Increase in WTP Annual Costs - Paymaster	LS	$ 67,109.39	1	$ 67,109	Proportion based on flow rate
Incremental Increase in WTP Annual Costs - UMH	LS	$ 107,238.17	1	$ 107,238	Proportion based on flow rate
Annual Maintenance of Pipelines and Pump Stations	LS	$ 89,400.00	1	$ 89,400	5% initial construction
Periodic Replacement of Parts and Equipment - New Collection Systems, Years 15 and 30	LS	$ 268,200.00	1	$ 268,200	15% initial construction
Periodic Replacement of Parts and Equipment - Existing Collection Systems, Years 15 and 30	LS	$ 60,000.00	1	$ 60,000	Engineer Estimate
			Subtotal	$ 894,135	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 11,438,439**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 17,456,362 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 2 COSTS								
ACTIVE TREATMENT - PHYSICAL/MECHANICAL (CERAMIC MICROFILTRATION)	**Anaconda Mine (EU 1) Adit Discharge**	**Carbonate Mine (EU 4) Groundwater**	**Mike Horse Mine (EU 8) Adit Discharge and Seeps**	**Paymaster Gulch Groundwater Aquifers**	**Upper Mike Horse Mine Bedrock Groundwater Aquifer**	**Capital Mine Adit Plug**		**TOTAL**
Preliminary Design and Detailed Site Investigations	$ -	$ 158,000	$ -	$ 171,500	$ 277,500	$ -		$ 607,000
Construct Capture and Conveyance System	$ -	$ 719,000	$ -	$ 477,500	$ 591,500	$ -		$ 1,788,000
Expansion of WTP	$ -	$ 420,470	$ -	$ 455,060	$ 727,160	$ -		$ 1,602,690
Subtotal	$ -	$ 1,297,470	$ -	$ 1,104,060	$ 1,596,160	$ -		$ 3,997,690
Mob/Demob (10%)	$ -	$ 129,747	$ -	$ 110,406	$ 159,616	$ -		$ 399,769
Subtotal	$ -	$ 1,427,217	$ -	$ 1,214,466	$ 1,755,776	$ -		$ 4,397,459
Contingencies (15%)	$ -	$ 214,083	$ -	$ 182,170	$ 263,366	$ -		$ 659,619
Subtotal	$ -	$ 1,641,300	$ -	$ 1,396,636	$ 2,019,142	$ -		$ 5,057,078
Project Management (5%)	$ -	$ 82,065	$ -	$ 69,832	$ 100,957	$ -		$ 252,854
Engineering (6%)	$ -	$ 98,478	$ -	$ 83,798	$ 121,149	$ -		$ 303,425
Construction Administration (8%)	$ -	$ 131,304	$ -	$ 111,731	$ 161,531	$ -		$ 404,566
Total, Capital Cost	$ -	$ 1,953,146	$ -	$ 1,661,997	$ 2,402,779	$ -		$ 6,017,923
Operations and Maintenance (O & M)								
Exist WTP Annual Operational Costs	$ 16,662	$ -	$ 223,515	$ -	$ -	$ -		$ 240,178
Incremental Increase in WTP Annual Costs - Carbonate	$ -	$ 62,009	$ -	$ -	$ -	$ -		$ 62,009
Incremental Increase in WTP Annual Costs - Paymaster	$ -	$ -	$ -	$ 67,109	$ -	$ -		$ 67,109
Incremental Increase in WTP Annual Costs - UMH	$ -	$ -	$ -	$ -	$ 107,238	$ -		$ 107,238
Annual Maintenance of pipelines and pump stations	$ -	$ 23,455	$ -	$ 25,384	$ 40,562			$ 89,400
Periodic Replacement of Parts and Equipment - New Collection Systems, Years 15 and 30	$ 10,000	$ 100,326	$ 50,000	$ 68,579	$ 99,295	$ -		$ 328,200
Total, 30-yr Present Worth, O & M (3%)	$ 337,119	$ 1,780,826	$ 4,433,677	$ 1,885,151	$ 3,001,555	$ -		$ 11,438,327
TOTAL CAPITAL COST + O & M	$ 337,119	$ 3,733,973	$ 4,433,677	$ 3,547,147	$ 5,404,334	$ -		$ 17,456,250
TOTAL EA2 ACTIVE TREATMENT PHYSICAL/MECHANICAL COST WITH 30-YR PRESENT WORTH O & M								**$ 17,456,250**

Note: Given the current design of the WTP, it is difficult to segregate chemical treatment costs from physical treatment costs; therefore, for cost estimation purposes, the overall costs were allocated equally.

EA2 COST ESTIMATE DETAIL
ACTIVE TREATMENT - PHYSICAL/MECHANICAL (CERAMIC MICROFILTRATION)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 399,769.00	1	$ 399,769	10% of construction cost
Preliminary Design and Detailed Site Investigations					
Anaconda Mine (EU 1) Adit Discharge	LS	$ 1.00	0	$ -	Already in Place
Carbonate Mine (EU 4) Groundwater - Total				$ 158,000	
Detailed Site Characterization at Removal site	LS	$ 23,000.00	1	$ 23,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 23,000.00	1	$ 23,000	Batch & Column; Implementation and reporting
Computer Modeling (CSM)	LS	$ 10,000.00	1	$ 10,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 17,000.00	1	$ 17,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 85,000.00	1	$ 85,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Mike Horse Mine (EU 8) Adit Discharge and Seeps	LS	$ 1.00	0	$ -	Already in Place
Paymaster Gulch Groundwater Aquifers - Total				$ 171,500	
Detailed Site Characterization	LS	$ 25,000.00	1	$ 25,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 25,000.00	1	$ 25,000	Batch & Column; Implementation and Reporting
Computer Modeling (CSM)	LS	$ 11,000.00	1	$ 11,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 18,500.00	1	$ 18,500	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 92,000.00	1	$ 92,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Upper Mike Horse Mine Bedrock Groundwater Aquifer - Total				$ 277,500	
Detailed Site Characterization	LS	$ 40,000.00	1	$ 40,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 40,000.00	1	$ 40,000	Batch & Column; Implementation and Reporting
Computer Modeling (CSM)	LS	$ 17,500.00	1	$ 17,500	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 30,000.00	1	$ 30,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 150,000.00	1	$ 150,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Construct Capture and Conveyance System					
Carbonate Mine (EU 4) Groundwater - Total				$ 719,000	
Install Sheet Pile Cutoff	LF	$ 250.00	600	$ 150,000	
Construct Interception Trench	LF	$ 200.00	600	$ 120,000	600 feet x 6 feet x 120 feet
Install Extraction Wells	EA	$ 12,000.00	2	$ 24,000	$100/feet, 120 feet deep
Construct Pumping Station	LS	$ 60,000.00	1	$ 60,000	
Construct Conveyance Pipeline	LF	$ 50.00	7,300	$ 365,000	
Paymaster Gulch Groundwater Aquifers - Total				$ 477,500	
Install Sheet Pile Cutoff	LF	$ 250.00	320	$ 80,000	
Construct Interception Trench	LF	$ 200.00	320	$ 64,000	600 feet x 6 feet x 120 feet
Install Extraction Wells	EA	$ 12,000.00	2	$ 24,000	$100/feet, 120 feet deep
Construct Pumping Station	LS	$ 60,000.00	1	$ 60,000	
Construct Conveyance Pipeline	LF	$ 50.00	4,990	$ 249,500	
Upper Mike Horse Mine Bedrock Groundwater Aquifer - Total				$ 591,500	
Install Sheet Pile Cutoff	LF	$ 250.00	325	$ 81,250	
Construct Interception Trench	LF	$ 200.00	325	$ 65,000	600 feet x 6 feet x 120 feet
Install Extraction Wells	EA	$ 12,000.00	2	$ 24,000	$100/feet, 120 feet deep
Construct Pumping Station	LS	$ 60,000.00	1	$ 60,000	
Construct Conveyance Pipeline	LF	$ 50.00	7,225	$ 361,250	

EA2 COST ESTIMATE DETAIL
ACTIVE TREATMENT - PHYSICAL/MECHANICAL (CERAMIC MICROFILTRATION)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Expansion of WTP		$ 1,602,690.00		$ 1,602,690	
Carbonate Mine (EU 4) Groundwater	LS	$ 420,470.00	1	$ 420,470	Proportion of 1/2 existing WTP, based on flow
Paymaster Gulch Groundwater Aquifers	LS	$ 455,060.00	1	$ 455,060	Proportion of 1/2 existing WTP, based on flow
Upper Mike Horse Mine Bedrock Groundwater Aquifer	LS	$ 727,160.00	1	$ 727,160	Proportion of 1/2 existing WTP, based on flow
			Subtotal	$ 4,397,459	
Contingencies		15%		$ 659,619	
			Subtotal	$ 5,057,078	
Project Management		5%		$ 252,854	
Engineering		6%		$ 303,425	
Construction Management		8%		$ 404,566	
TOTAL				$ 6,017,923	
			TOTAL CAPITAL COSTS	**$ 6,017,923**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Exist WTP Annual Operational Costs	LS	$ 240,177.50	1	$ 240,178	2013 WTP Budget - DEQ - Divided in half for using only half of the process
Incremental Increase in WTP Annual Costs - Carbonate	LS	$ 62,009.46	1	$ 62,009	Proportion based on flow rate
Incremental Increase in WTP Annual Costs - Paymaster	LS	$ 67,109.39	1	$ 67,109	Proportion based on flow rate
Incremental Increase in WTP Annual Costs - UMH	LS	$ 107,238.17	1	$ 107,238	Proportion based on flow rate
Annual Maintenance of pipelines and pump stations	LS	$ 89,400.00	1	$ 89,400	5% initial construction
Periodic Replacement of Parts and Equipment - New Collection Systems, Years 15 and 30	LS	$ 268,200.00	1	$ 268,200	15% initial construction
Periodic Replacement of Parts and Equipment - Existing Collection Systems, Years 15 and 30	LS	$ 60,000.00	1	$ 60,000	Engineer Estimate
			Subtotal	$ 894,135	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 11,438,439**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 17,456,362 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 2 COSTS								
PASSIVE TREATMENT (PRB)	**Anaconda Mine (EU 1) Adit Discharge**	**Carbonate Mine (EU 4) Groundwater**	**Mike Horse Mine (EU 8) Adit Discharge and Seeps**	**Paymaster Gulch Groundwater Aquifers**	**Upper Mike Horse Mine Bedrock Groundwater Aquifer**	**Capital Mine Adit Plug**		**TOTAL**
Preliminary Design and Detailed Site Investigations	$ 128,000	$ 158,000	$ 205,000	$ 158,000	$ -	$ -		$ 649,000
Construct PRB Reactor	$ 78,000	$ 225,000	$ 871,500	$ 42,720	$ -	$ -		$ 1,217,220
Subtotal	$ 206,000	$ 383,000	$ 1,076,500	$ 200,720	$ -	$ -		$ 1,866,220
Mob/Demob (10%)	$ 20,600	$ 38,300	$ 107,650	$ 20,072	$ -	$ -		$ 186,622
Subtotal	$ 226,600	$ 421,300	$ 1,184,150	$ 220,792	$ -	$ -		$ 2,052,842
Contingencies (15%)	$ 33,990	$ 63,195	$ 177,623	$ 33,119	$ -	$ -		$ 307,926
Subtotal	$ 260,590	$ 484,495	$ 1,361,773	$ 253,911	$ -	$ -		$ 2,360,768
Project Management (5%)	$ 13,030	$ 24,225	$ 68,089	$ 12,696	$ -	$ -		$ 118,038
Engineering (6%)	$ 15,635	$ 29,070	$ 81,706	$ 15,235	$ -	$ -		$ 141,646
Construction Administration (8%)	$ 20,847	$ 38,760	$ 108,942	$ 20,313	$ -	$ -		$ 188,861
Total, Capital Cost	$ 310,102	$ 576,549	$ 1,620,509	$ 302,154	$ -	$ -		$ 2,809,314
Operations and Maintenance (O & M)								
Environmental and System Performance Monitoring	$ 13,000	$ 13,000	$ 13,000	$ 13,000	$ -	$ -		$ 52,000
Barrier Replacement	$ 28,000	$ 34,000	$ 40,000	$ 34,000	$ -	$ -		$ 136,000
Water Disposal/Onsite	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ -	$ -		$ 8,000
Misc. Support and Administrative	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ -	$ -		$ 60,000
Total, 30-yr Present Worth, O & M (3%)	$ 1,136,826	$ 1,254,428	$ 1,372,031	$ 1,254,428	$ -	$ -		$ 5,017,713
TOTAL CAPITAL COST + O & M	$ 1,446,928	$ 1,830,977	$ 2,992,540	$ 1,556,582	$ -	$ -		$ 7,827,027
TOTAL EA2 COST WITH 30-YR PRESENT WORTH O & M								**$ 7,827,027**

EA2 COST ESTIMATE DETAIL
PASSIVE TREATMENT - CHEMICAL REAGENT (PRB)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 186,622.00	1	$ 186,622	10% of construction cost
Preliminary Design and Detailed Site Investigations					
Anaconda Mine (EU 1) Adit Discharge - Total				$ 128,000	
Detailed Site Characterization	LS	$ 20,000.00	1	$ 20,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 20,000.00	1	$ 20,000	Batch & Column; Implementation andReporting
Computer Modeling (CSM)	LS	$ 8,000.00	1	$ 8,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 15,000.00	1	$ 15,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 65,000.00	1	$ 65,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Carbonate Mine (EU 4) Groundwater - Total				$ 158,000	
Detailed Site Characterization at Removal site	LS	$ 23,000.00	1	$ 23,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 23,000.00	1	$ 23,000	Batch & Column; Implementation and Reporting
Computer Modeling (CSM)	LS	$ 10,000.00	1	$ 10,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 17,000.00	1	$ 17,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 85,000.00	1	$ 85,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Mike Horse Mine (EU 8) Adit Discharge and Seeps - Total				$ 205,000	
Detailed Site Characterization	LS	$ 35,000.00	1	$ 35,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 35,000.00	1	$ 35,000	Batch & Column; Implementation and reporting
Computer Modeling (CSM)	LS	$ 15,000.00	1	$ 15,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 25,000.00	1	$ 25,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 95,000.00	1	$ 95,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access
Paymaster Gulch Alluvial Aquifer - Total				$ 158,000	
Detailed Site Characterization	LS	$ 23,000.00	1	$ 23,000	Ground based EM (Resistivity) Survey; Subsurface Mapping; Environmental Sampling (Solids and Water - Analysis, Interpreting, and Reporting)
Lab Based Treatability Studies	LS	$ 23,000.00	1	$ 23,000	Batch & Column; Implementation and reporting
Computer Modeling (CSM)	LS	$ 10,000.00	1	$ 10,000	Hydrological / Hydrogeological; Biogeochemical
Preliminary Engineering Design	LS	$ 17,000.00	1	$ 17,000	Prepare, Review, and Approve; Preliminary Regulatory Compliance / Permitting
Pilot-Scale Testing	LS	$ 85,000.00	1	$ 85,000	Study Design and Documentation; Implementation (Procure, Install and Monitor); Integrated Data Access

EA2 COST ESTIMATE DETAIL
PASSIVE TREATMENT - CHEMICAL REAGENT (PRB)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Construct PRB Reactor					
Anaconda Mine (EU 1) Adit Discharge					
Installation	LS	$ 78,000.00	1	$ 78,000	Using Biopolymer Trenching; Continuous Wall Option or Funnel and Gate Option
Carbonate Mine (EU 4) Groundwater					
Installation	LS	$ 225,000.00	1	$ 225,000	Using Biopolymer Trenching; Continuous Wall Option or Funnel and Gate Option
Mike Horse Mine (EU 8) Adit Discharge and Seeps					
Installation	LS	$ 871,500.00	1	$ 871,500	Using Biopolymer Trenching; Continuous Wall Option or Funnel and Gate Option
Paymaster Gulch Alluvial Aquifer					
Installation	LS	$ 42,720.00	1	$ 42,720	Using Biopolymer Trenching; Continuous Wall Option or Funnel and Gate Option
			Subtotal	$ 2,052,842	
Contingencies		15%		$ 307,926	
			Subtotal	$ 2,360,768	
Project Management		5%		$ 118,038	
Engineering		6%		$ 141,646	
Construction Management		8%		$ 188,861	
TOTAL				$ 2,809,314	
			TOTAL CAPITAL COSTS	**$ 2,809,314**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Environmental and System Performance Monitoring	LS	$ 52,000.00	1	$ 52,000	$13,000 each
Barrier Replacement	LS	$ 136,000.00	1	$ 136,000	$34,000 each
Water Disposal/Onsite	LS	$ 8,000.00	1	$ 8,000	$2,000 each
Misc. Support and Administrative	LS	$ 60,000.00	1	$ 60,000	$15,000 each
			Subtotal	$ 256,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 5,017,713**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 7,827,027

EA 2 QUANTITY ESTIMATES								
	Distance to WTP	**Length Cutoff Wall**	**Depth Cutoff Wall**	**Flow Rate to Treat**				
		(FT)		**(GPM)**				
Anaconda Mine (EU 1) Adit Discharge	0	0	0	4.1				
Carbonate Mine (EU 4) Groundwater	7,300	600	120	14.2				
Mike Horse Mine (EU 8) Adit Discharge and Seeps	0	0	0	55.0				
Paymaster Gulch Groundwater Aquifers	4,990	320	120	15.4				
Upper Mike Horse Mine Bedrock Groundwater Aquifer	7,225	325	120	24.6				
Capital Mine Adit Plug	0	0	0	0.0				
	19,515	1,245	360	113				
Assumed flows	**K**	**i***	**Depth**	**Width**	**A**	**Flow**		Notes
	(ft/day)	(ft/ft)	(ft)	(ft)	(sf)	FT^3/day	gpm	
Mike Horse Bedrock	10	0.015	100	325	32500	4727.273	24.56	Textbook Value for K for fractured bedrock; gradient taken as 1/10th the ground slope; depth = upper 100'; Width = width of valley
Paymaster Alluvial Aquifer	3.8	0.0079	45	320	14400	432	2.24	K= that for LCMW-1 in RI; gradient taken as 1/10th the ground slope; Depth based on Well Log PMGW-120; Width = width of valley
Paymaster Bedrock Aquifer	10	0.0079	100	320	32000	2526.316	13.12	Textbook Value for K for fractured bedrock; gradient taken as 1/10th the ground slope; depth = upper 100'; Width = width of valley
Current Treatment Plant Flow	59	gpm						
Current Treatment Plant Construction Cost	$ 3,500,000	estimate from DEQ						
For Partial Treatment (Chemical Reagent or Microfiltration), assume the cost to expand the treatment plant would be approximately 1/2 this cost because of potential building addition.	$ 1,750,000							Use this cost for individual sites, proportioned by flow rate.

Improve/Reconstruct Access Roads

	ft	$/acre	$/sf	$/lf	
width	14				
Clear & Grub		5175	0.1188017	2.00	
Grading/Earthwork				11	Bald Butte
Reclaim				5	
				18.00	

Retention pond

FLOW	0.1	GPM	
VOLUME	52560	CF/YEAR	
AREA	17520	SF	ASSUMING 3' DEPTH
DIMENSIONS			
LENGTH	199		
WIDTH	88		
EXCAVATION VOL	1,298	CY	CUT/FILL BALANCE
ROCK	10	CY	EMERGENCY OVERFLOW
COST			
EXCAV	$12	PER CY	
ROCK	$35	PER CY	
REVEG	$2,500	PER AC	
PER POND	$17,130.00		

EA 2 COSTS

SITE-WIDE ELEMENT	Anaconda Mine (EU 1) Adit Discharge	Carbonate Mine (EU 4) Groundwater	Mike Horse Mine (EU 8) Adit Discharge and Seeps	Paymaster Gulch Groundwater Aquifers	Upper Mike Horse Mine Bedrock Groundwater Aquifer	Capital Mine Adit Plug	TOTAL
Institutional Controls	$ -	$ 5,000	$ -	$ 5,000	$ 5,000	$ -	**$ 15,000**
Access Restrictions							
Construct Fence	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Install Gates	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Install Warning Signs	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Mob/Demob (10%)	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Contingencies (15%)	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Project Management (5%)	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Engineering (6%)	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Construction Administration (8%)	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Total, Access Restrictions	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Long Term Monitoring & Maintenance (M&M)							
Site Security, Fence and Sign Maintenance, Years 1-30 (Annual)	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Periodic Replacement - Years 15 and 30	$ -	$ -	$ -	$ -	$ -	$ -	**$ -**
Total, 30-yr Present Worth, Long Term M&M (3%)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	**$ -**
TOTAL EA 2 SITE-WIDE ELEMENTS WITH 30-YR PRESENT WORTH LONG TERM M&M							**$ 15,000**

TABLE G-C.EA1-2 - CONCEPTUAL COST ESTIMATE EA1
#REF!
#REF!

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
INSTITUTIONAL CONTROLS					
Anaconda Mine (EU 1) Adit Discharge	LS	$ 5,000.00	0	$ -	Per DEQ
Carbonate Mine (EU 4) Groundwater	LS	$ 5,000.00	1	$ 5,000	
Mike Horse Mine (EU 8) Adit Discharge and Seeps	LS	$ 5,000.00	0	$ -	
Paymaster Gulch Groundwater Aquifers	LS	$ 5,000.00	1	$ 5,000	
Upper Mike Horse Mine Bedrock Groundwater Aquifer	LS	$ 5,000.00	1	$ 5,000	
Capital Mine Adit Plug	LS	$ 5,000.00	0	$ -	
			TOTAL ICs COSTS	**$ 15,000**	

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
ACCESS RESTRICTIONS					
Mobilization, Bonding, Insurance	LS	$ -	1	$ -	10% of construction cost
Install Farm Fence	LF	$ 5.50	0	$ -	Bald Butte/Great Divide
Anaconda Mine (EU 1) Adit Discharge	LF	$ 5.50	0	$ -	
Carbonate Mine (EU 4) Groundwater	LF	$ 5.50	0	$ -	
Mike Horse Mine (EU 8) Adit Discharge and Seeps	LF	$ 5.50	0	$ -	
Paymaster Gulch Groundwater Aquifers	LF	$ 5.50	0	$ -	
Upper Mike Horse Mine Bedrock Groundwater Aquifer	LF	$ 5.50	0	$ -	
Capital Mine Adit Plug	LF	$ 5.50	0	$ -	
Metal Security Gate	EA	$ 1,500.00	0	$ -	Based on Section 35 Bid Tabs
Anaconda Mine (EU 1) Adit Discharge	EA	$ 1,500.00	0	$ -	
Carbonate Mine (EU 4) Groundwater	EA	$ 1,500.00	0	$ -	
Mike Horse Mine (EU 8) Adit Discharge and Seeps	EA	$ 1,500.00	0	$ -	
Paymaster Gulch Groundwater Aquifers	EA	$ 1,500.00	0	$ -	
Upper Mike Horse Mine Bedrock Groundwater Aquifer	EA	$ 1,500.00	0	$ -	
Capital Mine Adit Plug	EA	$ 1,500.00	0	$ -	
Metal Warning Signs	EA	$ 150.00	0	$ -	Engineer Estimate
Anaconda Mine (EU 1) Adit Discharge	EA	$ 150.00	0	$ -	
Carbonate Mine (EU 4) Groundwater	EA	$ 150.00	0	$ -	
Mike Horse Mine (EU 8) Adit Discharge and Seeps	EA	$ 150.00	0	$ -	
Paymaster Gulch Groundwater Aquifers	EA	$ 150.00	0	$ -	
Upper Mike Horse Mine Bedrock Groundwater Aquifer	EA	$ 150.00	0	$ -	
Capital Mine Adit Plug	EA	$ 150.00	0	$ -	
			Subtotal	$ -	
Contingencies		15%		$ -	
			Subtotal	$ -	
Project Management		5%		$ -	
Engineering		6%		$ -	
Construction Management		8%		$ -	
TOTAL				$ -	
			TOTAL CAPITAL COSTS	**$ -**	

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Security, Fence and Sign Maintenance, Years 1-30	LS	$ 2,500.00	0	$ -	Engineers Estimate
Periodic Replacement - Years 15 and 30	LS	$ -	1	$ -	1/2 of fence replaced
			Subtotal	$ -	
	30-YEAR NET PRESENT VALUE ANNUAL O&M COSTS			**$0.00**	**Discounted using the Rate Below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (ICS + ACCESS RESTRICTIONS + O&M COST) **$15,000**

EVALUATION AREA	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS													
EA 3					PHYSICAL HAZARDS/SOLID MEDIA							SURFACE WATER					
Surface Water and Sediment				No Action	Monitored Natural Recovery	ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT		ENGINEERING CONTROLS			TREATMENT		
										In-situ	Ex-situ				Active		Passive
	ICs	Access Restrictions	Long-term Monitoring and Maintenance			Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Neutralization W/Alkaline Amendment	Containment (Retention Pond)	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Blackfoot River (EU13)	$0.00	$0.00	$0.00	$0.00	$545,031	N/A	N/A	$5,405,401	$5,676,601	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stevens Creek	$0.00	$0.00	$0.00	$0.00	$436,025	N/A	N/A	$592,804	$601,184	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Porcupine Creek	$0.00	$0.00	$0.00	$0.00	$272,516	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paymaster Creek	$0.00	$0.00	$0.00	$0.00	$436,025	N/A	N/A	$99,483	$99,940	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Shave Creek	$0.00	$0.00	$0.00	$0.00	$311,446	N/A	N/A	$104,903	$105,360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Unnamed Tributary above WTP	$0.00	$0.00	$0.00	$0.00	$179,082	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mine Feature BR-01 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$66,264	N/A	N/A	N/A	N/A	N/A
Mine Feature BR-14 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$123,166	N/A	N/A	N/A	N/A	N/A
Mine Feature PBBS Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	$94,981	$95,743	N/A	N/A	$98,779	N/A	N/A	N/A	N/A	N/A
Mine Feature PC-11 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$55,425	N/A	N/A	N/A	N/A	N/A
Mine Feature PC-22 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$47,297	N/A	N/A	N/A	N/A	N/A
Mine Feature SH-43 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	$29,046	$29,504	N/A	N/A	$52,716	N/A	N/A	N/A	N/A	N/A
Mine Feature SG-55 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$220,713	N/A	N/A	N/A	N/A	N/A
Mine Feature SG-71 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$98,779	N/A	N/A	N/A	N/A	N/A
Mine Feature SG-94 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	$34,466	$34,923	N/A	N/A	$58,135	N/A	N/A	N/A	N/A	N/A
Mine Feature SG-98 Discharge Seep, or Spring	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$253,228	N/A	N/A	N/A	N/A	N/A
Historic Paymaster Adit Discharge	$0.00	$5,796	$6,928	$0.00	$0.00	N/A	N/A	N/A	N/A	N/A	N/A	$41,877	N/A	N/A	N/A	N/A	N/A
TOTAL COSTS	**$0**	**$63,752**	**$76,209**	**$0**	**$2,180,125**	**$0**	**$0**	**$6,361,084**	**$6,643,253**	**$0**	**$0**	**$1,116,380**	**$0**	**$0**	**$0**	**$0**	**$0**

EA 3 COSTS													
SITE-WIDE ELEMENTS	**Mine Feature BR-01 Discharge Seep, or Spring**	**Mine Feature BR-14 Discharge Seep, or Spring**	**Mine Feature PBBS Discharge Seep, or Spring**	**Mine Feature PC-11 Discharge Seep, or Spring**	**Mine Feature PC-22 Discharge Seep, or Spring**	**Mine Feature SH-43 Discharge Seep, or Spring**	**Mine Feature SG-55 Discharge Seep, or Spring**	**Mine Feature SG-71 Discharge Seep, or Spring**	**Mine Feature SG-94 Discharge Seep, or Spring**	**Mine Feature SG-98 Discharge Seep, or Spring**	**Historic Paymaster Adit Discharge**		**TOTAL**
Institutional Controls	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Access Restrictions													
Construct Fence	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200		**$ 24,200**
Install Gates	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500		**$ 16,500**
Install Warning Signs	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150	$ 150		**$ 1,650**
Subtotal	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850	$ 3,850		**$ 42,350**
Mob/Demob (10%)	$ 385	$ 385	$ 385	$ 385	$ 385	$ 385	$ 385	$ 385	$ 385	$ 385	$ 385		**$ 4,235**
Subtotal	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235	$ 4,235		**$ 46,585**
Contingencies (15%)	$ 635	$ 635	$ 635	$ 635	$ 635	$ 635	$ 635	$ 635	$ 635	$ 635	$ 635		**$ 6,988**
Subtotal	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870	$ 4,870		**$ 53,573**
Project Management (5%)	$ 244	$ 244	$ 244	$ 244	$ 244	$ 244	$ 244	$ 244	$ 244	$ 244	$ 244		**$ 2,679**
Engineering (6%)	$ 292	$ 292	$ 292	$ 292	$ 292	$ 292	$ 292	$ 292	$ 292	$ 292	$ 292		**$ 3,214**
Construction Administration (8%)	$ 390	$ 390	$ 390	$ 390	$ 390	$ 390	$ 390	$ 390	$ 390	$ 390	$ 390		**$ 4,286**
Total, Access Restrictions	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796	$ 5,796		**$ 63,752**
Long-term Monitoring and Maintenance													
Site Security, Fence and Sign Maintenance, Years 1-30 (Annual)	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250		**$ 2,750**
Periodic Replacement - Years 15 and 30	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925	$ 1,925		**$ 21,175**
Total, 30-yr Present Worth, Long-term M&M (3%)	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928	$ 6,928		**$ 76,209**
TOTAL ACCESS RESTRICTIONS + LONG-TERM M&M	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724	$ 12,724		**$ 139,961**
TOTAL SITE-WIDE ELEMENTS COSTS WITH 30-YR PRESENT WORTH LONG-TERM M&M													**$ 139,961**

EA3 COST ESTIMATE DETAIL
SITE-WIDE ELEMENTS

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 4,235.00	1	$ 4,235	10% of construction cost
Install Farm Fence - Total	LF	$ 5.50	4,400	$ 24,200	Based on Bald Butte/Great Divide
Mine Feature BR-01 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature BR-14 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature PBBS Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature PC-11 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature PC-22 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature SH-43 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature SG-55 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature SG-71 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature SG-94 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Mine Feature SG-98 Discharge Seep, or Spring	LF	$ 5.50	400	$ 2,200	
Historic Paymaster Adit Discharge	LF	$ 5.50	400	$ 2,200	
Metal Security Gate - Total	EA	$ 1,500.00	11	$ 16,500	Based on Section 35 Bid Tabs
Mine Feature BR-01 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature BR-14 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature PBBS Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature PC-11 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature PC-22 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature SH-43 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature SG-55 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature SG-71 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature SG-94 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Mine Feature SG-98 Discharge Seep, or Spring	EA	$ 1,500.00	1	$ 1,500	
Historic Paymaster Adit Discharge	EA	$ 1,500.00	1	$ 1,500	
Metal Warning Signs - Total	EA	$ 150.00	11	$ 1,650	Engineer Estimate
Mine Feature BR-01 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature BR-14 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature PBBS Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature PC-11 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature PC-22 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature SH-43 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature SG-55 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature SG-71 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature SG-94 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Mine Feature SG-98 Discharge Seep, or Spring	EA	$ 150.00	1	$ 150	
Historic Paymaster Adit Discharge	EA	$ 150.00	1	$ 150	
			Subtotal	$ 46,585	
Contingencies		15%		$ 6,988	
			Subtotal	$ 53,573	
Project Management		5%		$ 2,679	
Engineering		6%		$ 3,214	
Construction Management		8%		$ 4,286	
TOTAL				$ 63,752	
			TOTAL CAPITAL COSTS	**$ 63,752**	

LONG-TERM MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Security, Fence and Sign Maintenance, Years 1-30	LS	$ 2,750.00	1	$ 2,750	Engineers Estimate
Periodic Replacement - Years 15 and 30	LS	$ 21,175.00	1	$ 21,175	1/2 of fence replaced
			Subtotal	**$ 23,925**	
	30-YEAR NET PRESENT VALUE ANNUAL M&M COSTS			**$ 76,216**	**Discounted using the rate below**

3% Assumed Discount Rate

Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

30-YEAR PRESENT VALUE (CAPITAL + M&M COST) $ 139,968

EA 3 COSTS								
MONITORED NATURAL RECOVERY	**Blackfoot River (EU13)**	**Stevens Creek**	**Porcupine Creek**	**Paymaster Creek**	**Shave Creek**	**Unnamed Tributary above WTP**		**TOTAL**
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Mob/Demob (10%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Contingencies (15%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Subtotal	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Project Management (5%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Engineering (6%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Construction Administration (8%)	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Total, Capital Cost	$ -	$ -	$ -	$ -	$ -	$ -		$ -
Operations and Maintenance (O& M)								
Semiannual Surface Water, Sediment Sampling, Analysis and Reporting, Years 1-10	$ 38,750	$ 31,000	$ 19,375	$ 31,000	$ 22,143	$ 12,732		$ 155,000
Annual Monitoring Years 11-30	$ 19,375	$ 15,500	$ 9,688	$ 15,500	$ 11,071	$ 6,366		$ 77,500
Total, 30-yr Present Worth, O & M (3%)	$ 545,031	$ 436,025	$ 272,516	$ 436,025	$ 311,446	$ 179,082		$ 2,180,125
TOTAL CAPITAL COST + O & M	$ 545,031	$ 436,025	$ 272,516	$ 436,025	$ 311,446	$ 179,082		$ 2,180,125
TOTAL EA3 MNR COSTS WITH 30-YR PRESENT WORTH O & M								**$ 2,180,125**

EA3 COST ESTIMATE DETAIL
MONITORED NATURAL RECOVERY

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
			Subtotal	$ -	
Contingencies		15%		$ -	
			Subtotal	$ -	
Project Management		5%		$ -	
Engineering		6%		$ -	
Construction Management		8%		$ -	
TOTAL				$ -	
			TOTAL CAPITAL COSTS	**$ -**	

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Semiannual Surface Water, Sediment Sampling, Analysis and Reporting, Years 1-10	LS	$155,000.00	1	$ 155,000	Based on current costs and increased to account for add'l stations and semiannual monitoring
Annual Monitoring Years 11-30	LS	$77,500.00	1	$ 77,500	
			Subtotal	$ 232,500	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 2,180,125**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (ICS + ACCESS RESTRICTIONS + O & M COSTS) $ 2,180,125

Surface Water and Sediment Monitoring	EA	$75,000.00	2	$150,000.00	Existing Annual Budget is ~$65K for SW/Sed. Add locations at Stevens, Shave.Porcupine, Unnamed Trib and make this semiannual (high + low flow)
Analysis and Report	EA	$5,000	1	$5,000.00	
			Annual Cost	$155,000.00	

EA 3 COSTS																				
REMOVAL AND ON-SITE DISPOSAL	**Blackfoot River (EU13)**	**Stevens Creek**	**Porcupine Creek**	**Paymaster Creek**	**Shave Creek**	**Unnamed Tributary above WTP**	**Mine Feature BR-01 Discharge Seep, or Spring**	**Mine Feature BR-14 Discharge Seep, or Spring**	**Mine Feature PBBS Discharge Seep, or Spring**	**Mine Feature PC-11 Discharge Seep, or Spring**	**Mine Feature PC-22 Discharge Seep, or Spring**	**Mine Feature SH-43 Discharge Seep, or Spring**	**Mine Feature SG-55 Discharge Seep, or Spring**	**Mine Feature SG-71 Discharge Seep, or Spring**	**Mine Feature SG-94 Discharge Seep, or Spring**	**Mine Feature SG-98 Discharge Seep, or Spring**	**Historic Paymaster Adit Discharge**		**TOTAL**
Floodplain Survey	$ 15,000	$ 5,000	$ -	$ 2,500	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 25,000
Sampling and Analysis Plan	$ 40,000	$ 10,000	$ -	$ 5,000	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 60,000
Surface Water and Sediment Control	$ 200,000	$ 10,000	$ -	$ 5,000	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 220,000
Dewatering	$ 44,500	$ 1,375	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 45,875
Improve/Construct Access Roads	$ 370,620	$ 32,400	$ -	$ -	$ 3,600	$ -	$ -	$ -	$ 37,800	$ -	$ -	$ 7,200	$ -	$ -	$ 10,800	$ -	$ -		$ 462,420
Excavate, Load, Haul and Place Waste in Repository	$ 267,000	$ 11,000	$ -	$ 450	$ 450	$ -	$ -	$ -	$ 1,250	$ -	$ -	$ 750	$ -	$ -	$ 750	$ -	$ -		$ 281,650
Load, Haul, Place Stream Substrate	$ 445,000	$ 16,500	$ -	$ 750	$ 750	$ -	$ -	$ -	$ 1,750	$ -	$ -	$ 1,050	$ -	$ -	$ 1,050	$ -	$ -		$ 466,850
Reconstruct Stream	$ 2,059,200	$ 252,000	$ -	$ 24,000	$ 24,000	$ -	$ -	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 2,371,200
Seed, Fertilize, Mulch	$ 13,791	$ 1,250	$ -	$ 1,250	$ 1,250	$ -	$ -	$ -	$ 1,250	$ -	$ -	$ 1,250	$ -	$ -	$ 1,250	$ -	$ -		$ 21,291
Subtotal	$ 3,455,111	$ 339,525	$ -	$ 38,950	$ 42,550	$ -	$ -	$ -	$ 54,050	$ -	$ -	$ 10,250	$ -	$ -	$ 13,850	$ -	$ -		$ 3,954,286
Mob/Demob (10%)	$ 345,511	$ 33,953	$ -	$ 3,895	$ 4,255	$ -	$ -	$ -	$ 5,405	$ -	$ -	$ 1,025	$ -	$ -	$ 1,385	$ -	$ -		$ 395,429
Subtotal	$ 3,800,622	$ 373,478	$ -	$ 42,845	$ 46,805	$ -	$ -	$ -	$ 59,455	$ -	$ -	$ 11,275	$ -	$ -	$ 15,235	$ -	$ -		$ 4,349,715
Contingencies (15%)	$ 570,093	$ 56,022	$ -	$ 6,427	$ 7,021	$ -	$ -	$ -	$ 8,918	$ -	$ -	$ 1,691	$ -	$ -	$ 2,285	$ -	$ -		$ 652,457
Subtotal	$ 4,370,716	$ 429,499	$ -	$ 49,272	$ 53,826	$ -	$ -	$ -	$ 68,373	$ -	$ -	$ 12,966	$ -	$ -	$ 17,520	$ -	$ -		$ 5,002,172
Project Management (5%)	$ 218,536	$ 21,475	$ -	$ 2,464	$ 2,691	$ -	$ -	$ -	$ 3,419	$ -	$ -	$ 648	$ -	$ -	$ 876	$ -	$ -		$ 250,109
Engineering (6%)	$ 262,243	$ 25,770	$ -	$ 2,956	$ 3,230	$ -	$ -	$ -	$ 4,102	$ -	$ -	$ 778	$ -	$ -	$ 1,051	$ -	$ -		$ 300,130
Construction Administration (8%)	$ 349,657	$ 34,360	$ -	$ 3,942	$ 4,306	$ -	$ -	$ -	$ 5,470	$ -	$ -	$ 1,037	$ -	$ -	$ 1,402	$ -	$ -		$ 400,174
Total, Capital Cost	$ 5,201,152	$ 511,104	$ -	$ 58,633	$ 64,053	$ -	$ -	$ -	$ 81,364	$ -	$ -	$ 15,430	$ -	$ -	$ 20,849	$ -	$ -		$ 5,952,585
Operations and Maintenance (O & M)																			
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	$ 20,000	$ 8,000	$ -	$ 4,000	$ 4,000	$ -	$ -	$ -	$ 1,333	$ -	$ -	$ 1,333	$ -	$ -	$ 1,333	$ -	$ -		$ 40,000
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	$ 7,500	$ 3,000	$ -	$ 1,500	$ 1,500	$ -	$ -	$ -	$ 500	$ -	$ -	$ 500	$ -	$ -	$ 500	$ -	$ -		$ 15,000
Total, 30-yr Present Worth, O & M (3%)	$ 204,250	$ 81,700	$ -	$ 40,850	$ 40,850	$ -	$ -	$ -	$ 13,617	$ -	$ -	$ 13,617	$ -	$ -	$ 13,617	$ -	$ -		$ 408,499
TOTAL CAPITAL COST + O & M	$ 5,405,401	$ 592,804	$ -	$ 99,483	$ 104,903	$ -	$ -	$ -	$ 94,981	$ -	$ -	$ 29,046	$ -	$ -	$ 34,466	$ -	$ -		$ 6,361,084
TOTAL EA3 REMOVAL AND ON-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O & M																			**$ 6,361,084**

EA3 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 395,428.63	1	$ 395,429	10% of construction cost
Floodplain Survey - Total				$ 25,000	
Blackfoot River (EU13)	LS	$ 15,000.00	1	$ 15,000	Engineer Estimate
Stevens Creek	LS	$ 5,000.00	1	$ 5,000	
Shave Creek	LS	$ 2,500.00	1	$ 2,500	
Paymaster Creek	LS	$ 2,500.00	1	$ 2,500	
Sampling and Analysis Plan - Total				$ 60,000	
Blackfoot River (EU13)	LS	$ 40,000.00	1	$ 40,000	Engineer Estimate
Stevens Creek	LS	$ 10,000.00	1	$ 10,000	
Shave Creek	LS	$ 5,000.00	1	$ 5,000	
Paymaster Creek	LS	$ 5,000.00	1	$ 5,000	
Surface Water and Sediment Control - Total				$ 220,000	
Blackfoot River (EU13)	LS	$ 200,000.00	1	$ 200,000	Engineer Estimate - General Site BMPs
Stevens Creek	LS	$ 10,000.00	1	$ 10,000	
Shave Creek	LS	$ 5,000.00	1	$ 5,000	
Paymaster Creek	LS	$ 5,000.00	1	$ 5,000	
Dewatering - Total			18,350	$ 45,875	Engineer Estimate
Blackfoot River (EU13)	CY	$ 2.50	17,800	$ 44,500	
Stevens Creek	CY	$ 2.50	550	$ 1,375	
Improve/Construct Access Roads - Total	LF	$ 18.00	25,690	$ 462,420	Includes Clear/Grub/Log, Reclamation
Blackfoot River (EU13)	LF	$ 18.00	20,590	$ 370,620	
Stevens Creek	LF	$ 18.00	1,800	$ 32,400	
Porcupine Creek	LF	$ 18.00	0	$ -	
Paymaster Creek	LF	$ 18.00	0	$ -	
Shave Creek	LF	$ 18.00	200	$ 3,600	
Unnamed Tributary above WTP	LF	$ 18.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	LF	$ 18.00	2,100	$ 37,800	
Mine Feature PC-11 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature PC-22 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	LF	$ 18.00	400	$ 7,200	
Mine Feature SG-55 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	LF	$ 18.00	600	$ 10,800	
Mine Feature SG-98 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Historic Paymaster Adit Discharge	LF	$ 18.00	0	$ -	

EA3 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Excavate, Load, Haul and Place Waste in Repository - Total	CY	$ 15.00	18,490	$ 281,650	Engineer Estimate
Blackfoot River (EU13)	CY	$ 15.00	17,800	$ 267,000	Volume estimated from 2012 Floodplain Study Report; includes 0.5 feet over-excavation
Stevens Creek	CY	$ 20.00	550	$ 11,000	
Porcupine Creek	CY	$ 15.00	0	$ -	
Paymaster Creek	CY	$ 15.00	30	$ 450	
Shave Creek	CY	$ 15.00	30	$ 450	
Unnamed Tributary above WTP	CY	$ 15.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	CY	$ 25.00	50	$ 1,250	
Mine Feature PC-11 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature PC-22 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	CY	$ 25.00	30	$ 750	
Mine Feature SG-55 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	CY	$ 25.00	30	$ 750	
Mine Feature SG-98 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Historic Paymaster Adit Discharge	CY	$ 25.00	0	$ -	
Load, Haul, Place Stream Substrate - Total	CY	$ 15.00	18,520	$ 466,850	Gravel and cobble substrate to rebuild disturbed areas
Blackfoot River (EU13)	CY	$ 25.00	17,800	$ 445,000	
Stevens Creek	CY	$ 30.00	550	$ 16,500	
Porcupine Creek	CY	$ 25.00	0	$ -	
Paymaster Creek	CY	$ 25.00	30	$ 750	
Shave Creek	CY	$ 25.00	30	$ 750	
Unnamed Tributary above WTP	CY	$ 25.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	CY	$ 35.00	50	$ 1,750	
Mine Feature PC-11 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature PC-22 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	CY	$ 35.00	30	$ 1,050	
Mine Feature SG-55 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	CY	$ 35.00	30	$ 1,050	
Mine Feature SG-98 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Historic Paymaster Adit Discharge	CY	$ 35.00	0	$ -	
Reconstruct Stream - Total			19,760	$ 2,371,200	
Blackfoot River (EU13)	LF	$ 120.00	17,160	$ 2,059,200	Engineers Estimate, Bid Tabs for similar jobs, Partial Reconstruction only 10% of length.
Stevens Creek	LF	$ 120.00	2,100	$ 252,000	
Porcupine Creek	LF	$ 120.00	0	$ -	
Paymaster Creek	LF	$ 120.00	200	$ 24,000	
Shave Creek	LF	$ 120.00	200	$ 24,000	
Unnamed Tributary above WTP	LF	$ 120.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	LF	$ 120.00	100	$ 12,000	
Mine Feature PC-11 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature PC-22 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-55 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-98 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Historic Paymaster Adit Discharge	LF	$ 120.00	0	$ -	

EA3 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 2,500.00	8.5	$ 21,291	Based on Bald Butte
Blackfoot River (EU13)	AC	$ 2,500.00	5.5	$ 13,791	
Stevens Creek	AC	$ 2,500.00	0.5	$ 1,250	
Porcupine Creek	AC	$ 2,500.00	0.0	$ -	
Paymaster Creek	AC	$ 2,500.00	0.5	$ 1,250	
Shave Creek	AC	$ 2,500.00	0.5	$ 1,250	
Unnamed Tributary above WTP	AC	$ 2,500.00	0.0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	AC	$ 2,500.00	0.5	$ 1,250	
Mine Feature PC-11 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature PC-22 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	AC	$ 2,500.00	0.5	$ 1,250	
Mine Feature SG-55 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	AC	$ 2,500.00	0.5	$ 1,250	
Mine Feature SG-98 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Historic Paymaster Adit Discharge	AC	$ 2,500.00	0.0	$ -	
			Subtotal	$ 4,349,715	
Contingencies		15%		$ 652,457	
			Subtotal	$ 5,002,172	
Project Management		5%		$ 250,109	
Engineering		6%		$ 300,130	
Construction Management		8%		$ 400,174	
TOTAL				$ 5,952,585	
			TOTAL CAPITAL COSTS	**$ 5,952,585**	

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	LS	$ 40,000.00	1	$ 40,000	Engineers Estimate
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	LS	$ 15,000.00	1	$ 15,000	Engineers Estimate
			Subtotal	$ 55,000	
30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS				**$ 408,499**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 6,361,084

EA 3 COSTS																				
REMOVAL AND OFF-SITE DISPOSAL	**Blackfoot River (EU13)**	**Stevens Creek**	**Porcupine Creek**	**Paymaster Creek**	**Shave Creek**	**Unnamed Tributary above WTP**	**Mine Feature BR-01 Discharge Seep, or Spring**	**Mine Feature BR-14 Discharge Seep, or Spring**	**Mine Feature PBBS Discharge Seep, or Spring**	**Mine Feature PC-11 Discharge Seep, or Spring**	**Mine Feature PC-22 Discharge Seep, or Spring**	**Mine Feature SH-43 Discharge Seep, or Spring**	**Mine Feature SG-55 Discharge Seep, or Spring**	**Mine Feature SG-71 Discharge Seep, or Spring**	**Mine Feature SG-94 Discharge Seep, or Spring**	**Mine Feature SG-98 Discharge Seep, or Spring**	**Historic Paymaster Adit Discharge**		**TOTAL**
Floodplain Survey	$ 15,000	$ 5,000	$ -	$ 2,500	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 25,000
Sampling and Analysis Plan	$ 40,000	$ 10,000	$ -	$ 5,000	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 60,000
Surface Water and Sediment Control	$ 200,000	$ 10,000	$ -	$ 5,000	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 220,000
Dewatering	$ 44,500	$ 1,375	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 45,875
Construct Off-site Repository	$ 180,157	$ 5,567	$ -	$ 304	$ 304	$ -	$ -	$ -	$ 506	$ -	$ -	$ 304	$ -	$ -	$ 304	$ -	$ -		$ 187,444
Improve/Construct Access Roads	$ 370,620	$ 32,400	$ -	$ -	$ 3,600	$ -	$ -	$ -	$ 37,800	$ -	$ -	$ 7,200	$ -	$ -	$ 10,800	$ -	$ -		$ 462,420
Excavate, Load, Haul and Place Waste in Repository	$ 267,000	$ 11,000	$ -	$ 450	$ 450	$ -	$ -	$ -	$ 1,250	$ -	$ -	$ 750	$ -	$ -	$ 750	$ -	$ -		$ 281,650
Load, Haul, Place Stream Substrate	$ 445,000	$ 16,500	$ -	$ 750	$ 750	$ -	$ -	$ -	$ 1,750	$ -	$ -	$ 1,050	$ -	$ -	$ 1,050	$ -	$ -		$ 466,850
Reconstruct Stream	$ 2,059,200	$ 252,000	$ -	$ 24,000	$ 24,000	$ -	$ -	$ -	$ 12,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 2,371,200
Seed, Fertilize, Mulch	$ 13,791	$ 1,250	$ -	$ 1,250	$ 1,250	$ -	$ -	$ -	$ 1,250	$ -	$ -	$ 1,250	$ -	$ -	$ 1,250	$ -	$ -		$ 21,291
Subtotal	$ 3,635,268	$ 345,092	$ -	$ 39,254	$ 42,854	$ -	$ -	$ -	$ 54,556	$ -	$ -	$ 10,554	$ -	$ -	$ 14,154	$ -	$ -		$ 4,141,731
Mob/Demob (10%)	$ 363,527	$ 34,509	$ -	$ 3,925	$ 4,285	$ -	$ -	$ -	$ 5,456	$ -	$ -	$ 1,055	$ -	$ -	$ 1,415	$ -	$ -		$ 414,173
Subtotal	$ 3,998,795	$ 379,601	$ -	$ 43,179	$ 47,139	$ -	$ -	$ -	$ 60,012	$ -	$ -	$ 11,609	$ -	$ -	$ 15,569	$ -	$ -		$ 4,555,904
Contingencies (15%)	$ 599,819	$ 56,940	$ -	$ 6,477	$ 7,071	$ -	$ -	$ -	$ 9,002	$ -	$ -	$ 1,741	$ -	$ -	$ 2,335	$ -	$ -		$ 683,386
Subtotal	$ 4,598,614	$ 436,541	$ -	$ 49,656	$ 54,210	$ -	$ -	$ -	$ 69,013	$ -	$ -	$ 13,350	$ -	$ -	$ 17,904	$ -	$ -		$ 5,239,289
Project Management (5%)	$ 229,931	$ 21,827	$ -	$ 2,483	$ 2,710	$ -	$ -	$ -	$ 3,451	$ -	$ -	$ 668	$ -	$ -	$ 895	$ -	$ -		$ 261,964
Engineering (6%)	$ 275,917	$ 26,192	$ -	$ 2,979	$ 3,253	$ -	$ -	$ -	$ 4,141	$ -	$ -	$ 801	$ -	$ -	$ 1,074	$ -	$ -		$ 314,357
Construction Administration (8%)	$ 367,889	$ 34,923	$ -	$ 3,972	$ 4,337	$ -	$ -	$ -	$ 5,521	$ -	$ -	$ 1,068	$ -	$ -	$ 1,432	$ -	$ -		$ 419,143
Total, Capital Cost	$ 5,472,351	$ 519,484	$ -	$ 59,090	$ 64,510	$ -	$ -	$ -	$ 82,126	$ -	$ -	$ 15,887	$ -	$ -	$ 21,306	$ -	$ -		$ 6,234,754
Operations and Maintenance (O & M)																			
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	$ 20,000	$ 8,000	$ -	$ 4,000	$ 4,000	$ -	$ -	$ -	$ 1,333			$ 1,333	$ -	$ -	$ 1,333	$ -	$ -		$ 40,000
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	$ 7,500	$ 3,000	$ -	$ 1,500	$ 1,500	$ -	$ -	$ -	$ 500	$ -	$ -	$ 500	$ -	$ -	$ 500	$ -	$ -		$ 15,000
Total, 30-yr Present Worth, O & M (3%)	$ 204,250	$ 81,700	$ -	$ 40,850	$ 40,850	$ -	$ -	$ -	$ 13,617	$ -	$ -	$ 13,617	$ -	$ -	$ 13,617	$ -	$ -		$ 408,499
TOTAL CAPITAL COST + O & M	$ 5,676,601	$ 601,184	$ -	$ 99,940	$ 105,360	$ -	$ -	$ -	$ 95,743	$ -	$ -	$ 29,504	$ -	$ -	$ 34,923	$ -	$ -		$ 6,643,253
TOTAL EA3 REMOVAL AND OFF-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O & M																			**$ 6,643,253**

EA3 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 414,173.06	1	$ 414,173	10% of construction cost
Floodplain Survey - Total				$ 25,000	
Blackfoot River (EU13)	LS	$ 15,000.00	1	$ 15,000	Engineer Estimate
Stevens Creek	LS	$ 5,000.00	1	$ 5,000	
Paymaster Creek	LS	$ 2,500.00	1	$ 2,500	
Shave Creek	LS	$ 2,500.00	1	$ 2,500	
Sampling and Analysis Plan - Total				$ 60,000	
Blackfoot River (EU13)	LS	$ 40,000.00	1	$ 40,000	Engineer Estimate
Stevens Creek	LS	$ 10,000.00	1	$ 10,000	
Paymaster Creek	LS	$ 5,000.00	1	$ 5,000	
Shave Creek	LS	$ 5,000.00	1	$ 5,000	
Surface Water and Sediment Control - Total				$ 220,000	
Blackfoot River (EU13)	LS	$ 200,000.00	1	$ 200,000	Engineer Estimate - General Site BMPs
Stevens Creek	LS	$ 10,000.00	1	$ 10,000	
Paymaster Creek	LS	$ 5,000.00	1	$ 5,000	
Shave Creek	LS	$ 5,000.00	1	$ 5,000	
Dewatering - Total			18,350	$ 45,875	Engineer Estimate
Blackfoot River (EU13)	CY	$ 2.50	17,800	$ 44,500	
Stevens Creek	CY	$ 2.50	550	$ 1,375	
Construct Off-site Repository - Total	CY	$ 10.12	18,520.0	$ 187,444	State Section 18*
Blackfoot River (EU13)	CY	$ 10.12	17,800	$ 180,157	
Stevens Creek	CY	$ 10.12	550	$ 5,567	
Porcupine Creek	CY	$ 10.12	0	$ -	
Paymaster Creek	CY	$ 10.12	30	$ 304	
Shave Creek	CY	$ 10.12	30	$ 304	
Unnamed Tributary above WTP	CY	$ 10.12	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	CY	$ 10.12	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	CY	$ 10.12	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	CY	$ 10.12	50	$ 506	
Mine Feature PC-22 Discharge Seep, or Spring	CY	$ 10.12	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	CY	$ 10.12	30	$ 304	
Mine Feature SG-55 Discharge Seep, or Spring	CY	$ 10.12	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	CY	$ 10.12	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	CY	$ 10.12	30	$ 304	
Mine Feature SG-98 Discharge Seep, or Spring	CY	$ 10.12	0	$ -	
Historic Paymaster Adit Discharge	CY	$ 10.12	0	$ -	
Improve/Construct Access Roads - Total	LF	$ 18.00	25,690	$ 462,420	Includes Clear/Grub/Log, Reclamation
Blackfoot River (EU13)	LF	$ 18.00	20,590	$ 370,620	
Stevens Creek	LF	$ 18.00	1,800	$ 32,400	
Porcupine Creek	LF	$ 18.00	0	$ -	
Paymaster Creek	LF	$ 18.00	0	$ -	
Shave Creek	LF	$ 18.00	200	$ 3,600	
Unnamed Tributary above WTP	LF	$ 18.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	LF	$ 18.00	2,100	$ 37,800	
Mine Feature PC-22 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	LF	$ 18.00	400	$ 7,200	
Mine Feature SG-55 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	LF	$ 18.00	600	$ 10,800	
Mine Feature SG-98 Discharge Seep, or Spring	LF	$ 18.00	0	$ -	
Historic Paymaster Adit Discharge	LF	$ 18.00	0	$ -	

EA3 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Excavate, Load, Haul and Place Waste in Repository - Total	CY	$ 15.00	18,490	$ 281,650	Engineer Estimate
Blackfoot River (EU13)	CY	$ 15.00	17,800	$ 267,000	Vol Est. = 4 ft width for 3.25 mi. Upper Marsh to Alice Ck
Stevens Creek	CY	$ 20.00	550	$ 11,000	
Porcupine Creek	CY	$ 15.00	0	$ -	
Paymaster Creek	CY	$ 15.00	30	$ 450	
Shave Creek	CY	$ 15.00	30	$ 450	
Unnamed Tributary above WTP	CY	$ 15.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	CY	$ 25.00	50	$ 1,250	
Mine Feature PC-22 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	CY	$ 25.00	30	$ 750	
Mine Feature SG-55 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	CY	$ 25.00	30	$ 750	
Mine Feature SG-98 Discharge Seep, or Spring	CY	$ 25.00	0	$ -	
Historic Paymaster Adit Discharge	CY	$ 25.00	0	$ -	
Load, Haul, Place Stream Substrate - Total	CY	$ 15.00	18,520	$ 466,850	Gravel and cobble substrate to rebuild disturbed areas
Blackfoot River (EU13)	CY	$ 25.00	17,800	$ 445,000	
Stevens Creek	CY	$ 30.00	550	$ 16,500	
Porcupine Creek	CY	$ 25.00	0	$ -	
Paymaster Creek	CY	$ 25.00	30	$ 750	
Shave Creek	CY	$ 25.00	30	$ 750	
Unnamed Tributary above WTP	CY	$ 25.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	CY	$ 35.00	50	$ 1,750	
Mine Feature PC-22 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	CY	$ 35.00	30	$ 1,050	
Mine Feature SG-55 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	CY	$ 35.00	30	$ 1,050	
Mine Feature SG-98 Discharge Seep, or Spring	CY	$ 35.00	0	$ -	
Historic Paymaster Adit Discharge	CY	$ 35.00	0	$ -	
Reconstruct Stream - Total				$ 2,371,200	
Blackfoot River (EU13)	LF	$ 120.00	17,160	$ 2,059,200	Engineers Estimate, Bid Tabs for similar jobs, Partial Reconstruction only 10% of length.
Stevens Creek	LF	$ 120.00	2,100	$ 252,000	
Porcupine Creek	LF	$ 120.00	0	$ -	
Paymaster Creek	LF	$ 120.00	200	$ 24,000	
Shave Creek	LF	$ 120.00	200	$ 24,000	
Unnamed Tributary above WTP	LF	$ 120.00	0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	LF	$ 120.00	100	$ 12,000	
Mine Feature PC-22 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-55 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Mine Feature SG-98 Discharge Seep, or Spring	LF	$ 120.00	0	$ -	
Historic Paymaster Adit Discharge	LF	$ 120.00	0	$ -	

EA3 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 2,500.00	8.5	$ 21,291	Based on Bald Butte
Blackfoot River (EU13)	AC	$ 2,500.00	5.5	$ 13,791	
Stevens Creek	AC	$ 2,500.00	0.5	$ 1,250	
Porcupine Creek	AC	$ 2,500.00	0.0	$ -	
Paymaster Creek	AC	$ 2,500.00	0.5	$ 1,250	
Shave Creek	AC	$ 2,500.00	0.5	$ 1,250	
Unnamed Tributary above WTP	AC	$ 2,500.00	0.0	$ -	
Mine Feature BR-01 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature BR-14 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature PBBS Discharge Seep, or Spring	AC	$ 2,500.00	0.5	$ 1,250	
Mine Feature PC-22 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature SH-43 Discharge Seep, or Spring	AC	$ 2,500.00	0.5	$ 1,250	
Mine Feature SG-55 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature SG-71 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Mine Feature SG-94 Discharge Seep, or Spring	AC	$ 2,500.00	0.5	$ 1,250	
Mine Feature SG-98 Discharge Seep, or Spring	AC	$ 2,500.00	0.0	$ -	
Historic Paymaster Adit Discharge	AC	$ 2,500.00	0.0	$ -	
			Subtotal	$ 4,555,904	
Contingencies		15%		$ 683,386	
			Subtotal	$ 5,239,289	
Project Management		5%		$ 261,964	
Engineering		6%		$ 314,357	
Construction Management		8%		$ 419,143	
TOTAL				$ 6,234,754	
			TOTAL CAPITAL COSTS	**$ 6,234,754**	

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	LS	$ 40,000.00	1	$ 40,000	Engineers Estimate
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	LS	$ 15,000.00	1	$ 15,000	Engineers Estimate
			Subtotal	$ 55,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 408,499**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 6,643,253

* From the Repository Siting Study for UBMC - State Section 18 Site estimate was $15,034,436 for a 1,000,000 cy repository and includes wastes removed under the EE/CA actions. The total estimated cost included hauling and placement of waste. Construction costs for the repository were $4,048,472. For purposes of this feasibility study, estimated costs from the siting study are scaled to a 400,000 cy repository for a repository construction cost of $10.12/cy.

EA 3 COSTS													
CONTAINMENT (RETENTION POND)	**Mine Feature BR-01 Discharge Seep, or Spring**	**Mine Feature BR-14 Discharge Seep, or Spring**	**Mine Feature PBBS Discharge Seep, or Spring**	**Mine Feature PC-22 Discharge Seep, or Spring**	**Mine Feature PC-22 Discharge Seep, or Spring**	**Mine Feature SH-43 Discharge Seep, or Spring**	**Mine Feature SG-55 Discharge Seep, or Spring**	**Mine Feature SG-71 Discharge Seep, or Spring**	**Mine Feature SG-94 Discharge Seep, or Spring**	**Mine Feature SG-98 Discharge Seep, or Spring**	**Historic Paymaster Adit Discharge**		**TOTAL**
Improve/Construct Access Roads	$ 16,200	$ 54,000	$ 37,800	$ 9,000	$ 3,600	$ 7,200	$ 118,800	$ 37,800	$ 10,800	$ 140,400	$ -		$ 435,600
Construct Retention Pond	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130	$ 17,130		$ 188,430
Seed, Fertilize, Mulch	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106	$ 1,106		$ 12,167
Subtotal	$ 34,436	$ 72,236	$ 56,036	$ 27,236	$ 21,836	$ 25,436	$ 137,036	$ 56,036	$ 29,036	$ 158,636	$ 18,236		$ 636,197
Mob/Demob (10%)	$ 3,444	$ 7,224	$ 5,604	$ 2,724	$ 2,184	$ 2,544	$ 13,704	$ 5,604	$ 2,904	$ 15,864	$ 1,824		$ 63,620
Subtotal	$ 37,880	$ 79,460	$ 61,640	$ 29,960	$ 24,020	$ 27,980	$ 150,740	$ 61,640	$ 31,940	$ 174,500	$ 20,060		$ 699,816
Contingencies (15%)	$ 5,682	$ 11,919	$ 9,246	$ 4,494	$ 3,603	$ 4,197	$ 22,611	$ 9,246	$ 4,791	$ 26,175	$ 3,009		$ 104,972
Subtotal	$ 43,562	$ 91,379	$ 70,886	$ 34,454	$ 27,623	$ 32,177	$ 173,351	$ 70,886	$ 36,731	$ 200,675	$ 23,069		$ 804,789
Project Management (5%)	$ 2,178	$ 4,569	$ 3,544	$ 1,723	$ 1,381	$ 1,609	$ 8,668	$ 3,544	$ 1,837	$ 10,034	$ 1,153		$ 40,239
Engineering (6%)	$ 2,614	$ 5,483	$ 4,253	$ 2,067	$ 1,657	$ 1,931	$ 10,401	$ 4,253	$ 2,204	$ 12,040	$ 1,384		$ 48,287
Construction Administration (8%)	$ 3,485	$ 7,310	$ 5,671	$ 2,756	$ 2,210	$ 2,574	$ 13,868	$ 5,671	$ 2,938	$ 16,054	$ 1,845		$ 64,383
Total, Capital Cost	$ 51,838	$ 108,741	$ 84,354	$ 41,000	$ 32,871	$ 38,290	$ 206,287	$ 84,354	$ 43,709	$ 238,803	$ 27,452		$ 957,699
Operations and Maintenance (O & M)													
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 409	$ 409	$ 409	$ 409	$ 409	$ 409	$ 409	$ 409	$ 409	$ 409	$ 409		$ 4,500
Periodic Repairs - Years 15 and 30 (1/3rd remedial cost pond construct and reveg)	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082	$ 6,082		$ 66,900
Total, 30-yr Present Worth, O & M (3%)	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426	$ 14,426		$ 158,682
TOTAL CAPITAL COST + O & M	$ 66,264	$ 123,166	$ 98,779	$ 55,425	$ 47,297	$ 52,716	$ 220,713	$ 98,779	$ 58,135	$ 253,228	$ 41,877		$ 1,116,380
TOTAL EA3 CONTAINMENT (RETENTION) COSTS WITH 30-YR PRESENT WORTH O & M													**$ 1,116,380**

EA3 COST ESTIMATE DETAIL
CONTAINMENT (RETENTION POND)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 63,619.67	1	$ 63,620	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	23,300	$ 435,600	Includes Clear/Grub/Log, Reclamation
Mine Feature BR-01 Discharge Seep, or Spring	LF	$ 18.00	900	$ 16,200	
Mine Feature BR-14 Discharge Seep, or Spring	LF	$ 18.00	3,000	$ 54,000	
Mine Feature PBBS Discharge Seep, or Spring	LF	$ 18.00	2,100	$ 37,800	
Mine Feature PC-11 Discharge Seep, or Spring	LF	$ 18.00	500	$ 9,000	
Mine Feature PC-22 Discharge Seep, or Spring	LF	$ 18.00	200	$ 3,600	
Mine Feature SH-43 Discharge Seep, or Spring	LF	$ 18.00	400	$ 7,200	
Mine Feature SG-55 Discharge Seep, or Spring	LF	$ 18.00	6,600	$ 118,800	
Mine Feature SG-71 Discharge Seep, or Spring	LF	$ 18.00	2,100	$ 37,800	
Mine Feature SG-94 Discharge Seep, or Spring	LF	$ 18.00	600	$ 10,800	
Mine Feature SG-98 Discharge Seep, or Spring	LF	$ 18.00	7,800	$ 140,400	
Historic Paymaster Adit Discharge	LF	$ 18.00	0	$ -	
Construct Retention Pond - Total	EA	$ 17,130.00	11	$ 188,430	Engineer Estimate
Mine Feature BR-01 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature BR-14 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature PBBS Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature PC-11 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature PC-22 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature SH-43 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature SG-55 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature SG-71 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature SG-94 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Mine Feature SG-98 Discharge Seep, or Spring	EA	$ 17,130.00	1	$ 17,130	
Historic Paymaster Adit Discharge	EA	$ 17,130.00	1	$ 17,130	
Seed, Fertilize, Mulch - Total	AC	$ 2,500.00	4.4	$ 12,167	Engineer Estimate
Mine Feature BR-01 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature BR-14 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature PBBS Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature PC-11 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature PC-22 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature SH-43 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature SG-55 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature SG-71 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature SG-94 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Mine Feature SG-98 Discharge Seep, or Spring	AC	$ 2,500.00	0.4	$ 1,106	
Historic Paymaster Adit Discharge	AC	$ 2,500.00	0.4	$ 1,106	
			Subtotal	$ 699,816	
Contingencies		15%		$ 104,972	
			Subtotal	$ 804,789	
Project Management		5%		$ 40,239	
Engineering		6%		$ 48,287	
Construction Management		8%		$ 64,383	
TOTAL				$ 957,699	
			TOTAL CAPITAL COSTS	**$ 957,699**	

EA3 COST ESTIMATE DETAIL
CONTAINMENT (RETENTION POND)

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 4,500.00	1	$ 4,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/3rd remedial cost pond construct and reveg)	LS	$ 66,900.00	1	$ 66,900	Engineers Estimate
			Subtotal	$ 71,400	
30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS				**$ 158,704**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 1,116,403 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 3 QUANTITY ESTIMATES					
SITE	**SEDIMENT**		**ACCESS - DIST. TO ROADS**		
	AREA	**VOLUME**	**LENGTH**	**IMPROVE?**	**FENCING**
	(sf)	**(cy)**	**(ft)**		**(ft)**
Blackfoot River (EU13)	240,300	17,800	20,590	YES	0
Stevens Creek	7,425	550	1,800	YES	0
Porcupine Creek	0	0	0	NO	0
Paymaster Creek	405	30	0	NO	0
Shave Creek	405	30	200	YES	0
Unnamed Tributary above WTP	0	0	300	YES	0
Mine Feature BR-01 Discharge Seep, or Spring	0	0	900	YES	400
Mine Feature BR-14 Discharge Seep, or Spring	0	0	3,000	YES	400
Mine Feature PBBS Discharge Seep, or Spring	675	50	2,100	YES	400
Mine Feature PC-11 Discharge Seep, or Spring	0	0	500	YES	400
Mine Feature PC-22 Discharge Seep, or Spring	0	0	200	YES	400
Mine Feature SH-43 Discharge Seep, or Spring	405	30	400	YES	400
Mine Feature SG-55 Discharge Seep, or Spring	0	0	6,600	YES	400
Mine Feature SG-71 Discharge Seep, or Spring	0	0	2,100	YES	400
Mine Feature SG-94 Discharge Seep, or Spring	405	30	600	YES	400
Mine Feature SG-98 Discharge Seep, or Spring	0	0	7,800	YES	400
Historic Paymaster Adit Discharge	0	0	0	NO	400
TOTALS	250,020	18,520	47,090		4,400

Improve/Reconstruct Access Roads

	ft	$/acre	$/sf	$/lf	
width	14				
Clear & Grub		5175	0.1188017	2.00	
Grading/Earthwork				11	Bald Butte
Reclaim				5	
				18.00	

Retention pond

FLOW	0.1	GPM	
VOLUME	52560	CF/YEAR	
AREA	17520	SF	ASSUMING 3' DEPTH
DIMENSIONS			
LENGTH	199		
WIDTH	88		
EXCAVATION VOL	1,298	CY	CUT/FILL BALANCE
ROCK	10	CY	EMERGENCY OVERFLOW

COST		
EXCAV	$12	PER CY
ROCK	$35	PER CY
REVEG	$2,500	PER AC

PER POND $17,130.00

TABLE C.4 - CONCEPTUAL COST ESTIMATE STATE SECTION 18 SITE

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Prepare Repository					
Strip and Stockpile Cover Soil and Subsoil	CY	$2.25	65,000	$ 146,250.00	Estimated 2-foot average is available at this site
Prepare Subgrade	SY	$1.00	96,800	$ 96,800.00	Estimated 20 acres
Special Excavation	CY	$9.00	0	$ -	Not required at this site
Load, Haul, Place, and Grade Structural Berm	CY	$25.00	0	$ -	Not required at this site
Install Geocushion	SY	$3.00	0	$ -	Not required at this site
Install Geomembrane	SY	$6.00	0	$ -	Not required at this site
Install Geocomposite Drainage Layer	SY	$4.00	0	$ -	Not required at this site
Install Leachate Collection System	LS	$37,000.00	0	$ -	Not required at this site
Place Tailings and Waste Rock					
Place and Compact Tailings In Repository	CY	$2.25	1,000,000	$ 2,250,000.00	Based on Bald Butte Bid Tabs
Close Repository					
Install Geomembrane Liner	SY	$6.00	96,800	$ 580,800.00	Based on Bald Butte Bid Tabs
Install Geocomposite Cap Drainage Layer	SY	$4.00	96,800	$ 387,200.00	Based on Bald Butte Bid Tabs
Replace Stockpiled Cover Soil	CY	$1.75	65,000	$ 113,750.00	Stockpiled Portion
Place Imported Cover Soil	CY	$1.20	0	$ -	Import From Nora Creek Site
Amend Cover Soil	TON	$350.00	487.5	$ 170,625	Amendment at 3% of top 6 inches of cover soil
Fertilize and Seed	AC	$800.00	20	$ 16,000	Based on Bald Butte Bid Tabs
Haul Roads					
Road Improvement	LF	$6.00	12,000	$ 72,000	Existing road surface upgrade and maintenance
New Road Construction	LF	$10.00	0	$ -	
Misc. Road Improvement	LS	$20,000.00	1	$ 20,000	Miscellaneous small culverts and highway access
Tailings and Borrow Material Haul					
Haul with Back Haul	CY	$ 6.57	400,000	$ 2,627,358	Assuming 400,000 cy of veg borrow required for reclamation
Haul without Back Haul	CY	$ 10.18	600,000	$ 6,108,607	
Back Haul Veg Borrow	CY	$ 3.61	400,000	$ 1,445,047	Assuming 400,000 cy of veg borrow required for reclamation
Excavate Borrow Materials	CY	$ 2.50	400,000	$ 1,000,000	Assuming 400,000 cy of veg borrow required for reclamation
Off-Site Borrow Area Development					
New Road Construction	LF	$10.00	0	$ -	Access to Nora Creek Site
Strip and Stockpile Cover Soil	CY	$2.25	0	$ -	Strip 2 feet from borrow area
Excavate Borrow Materials	CY	$2.50	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Haul Borrow Material	CY	$3.46	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Replace Stockpiled Cover Soil	CY	$1.25	0	$ -	Replace 2 inches of native cover
Fertilize and Seed	Ac	$800.00	0	$ -	Native seed and fertilizer
Other Costs					
Land Acquisition	AC	$1,200.00	0	$ -	Not required at this site
TOTAL				**$ 15,034,436**	

EVALUATION AREA	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS														
EA 4					PHYSICAL HAZARDS/SOLID MEDIA							SURFACE WATER/GROUNDWATER						
Upper Marsh				No Action	Monitored Natural Recovery	ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT		Monitored Natural Attenuation	ENGINEERING CONTROLS			TREATMENT		
										In-situ	Ex-situ					Active		Passive
	ICs	Access Restrictions	Long-term Monitoring and Maintenance			Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Neutralization W/Alkaline Amendment		Containment (Retention Pond)	Hydrologic and Hydraulic Control	Inundation	Chemical Reagent	Physical/ Mechanical	Chemical Reagent
Eastern Area	$5,000	$0	$0	$0	$182,849	N/A	$3,314,803	$4,465,125	$5,996,496	N/A	N/A	$154,719	N/A	N/A	N/A	N/A	N/A	N/A
Western Area	$5,000	$0	$0	$0	$182,849	N/A	$3,922,524	$5,380,951	$6,912,322	N/A	N/A	$154,719	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL COSTS	**$10,000**	**$0**	**$0**	**$0**	**$365,698**	**$0**	**$7,237,328**	**$9,846,075**	**$12,908,817**	**$0**	**$0**	**$309,437**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

EA 4 COSTS				
MONITORED NATURAL RECOVERY	**Eastern Area**	**Western Area**		**TOTAL**
Subtotal	$ -	$ -		$ -
Mob/Demob (10%)	$ -	$ -		$ -
Subtotal	$ -	$ -		$ -
Contingencies (15%)	$ -	$ -		$ -
Subtotal	$ -	$ -		$ -
Project Management (5%)	$ -	$ -		$ -
Engineering (6%)	$ -	$ -		$ -
Construction Administration (8%)	$ -	$ -		$ -
Total, Capital Cost	$ -	$ -		$ -
Operations and Maintenance (O & M)				
Semiannual Surface Water, Sediment Sampling, Analysis and Reporting, Years 1-10	$ 13,000	$ 13,000		$ 26,000
Annual Monitoring Years 11-30	$ 6,500	$ 6,500		$ 13,000
Total, 30-yr Present Worth, O & M (3%)	$ 182,849	$ 182,849		$ 365,698
TOTAL CAPITAL COST + O & M	$ 182,849	$ 182,849		$ 365,698
TOTAL EA4 MNR COSTS WITH 30-YR PRESENT WORTH O & M				**$ 365,698**

EA4 COST ESTIMATE DETAIL
MONITORED NATURAL RECOVERY*

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Contingencies		15%		$ -	
			Subtotal	$ -	
Project Management		5%		$ -	
Engineering		6%		$ -	
Construction Management		8%		$ -	
TOTAL				$ -	
			TOTAL CAPITAL COSTS	**$ -**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Semiannual Surface Water, Sediment Sampling, Analysis and Reporting, Years 1-10	LS	$26,000.00	1	$ 26,000	Based on current costs and increased to account for add'l stations and semiannual monitoring
Annual Monitoring Years 11-30	LS	$13,000.00	1	$ 13,000	
			Subtotal	$ 39,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 365,698**	**Discounted using the rate below**

* Surface water in the marsh is considered part of EA4 and is evaluated independent of the surface water for EA3.

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 365,698

Surface Water and Sediment Monitoring	EA	$12,000.00	2	$24,000.00	Existing Annual Budget is ~$65K for SW/Sed. Add locations above, below, and in the middle of upper marsh and make this semiannual (high + low flow)
Analysis and Report	EA	$2,000	1	$2,000.00	
		Annual Cost		$26,000.00	

EA 4 COSTS				
CONTAINMENT	**Eastern Area**	**Western Area**		**TOTAL**
Permitting	$ 20,000	$ 20,000		$ 40,000
Surface Water and Sediment Control	$ 30,000	$ 30,000		$ 60,000
Dewatering	$ 135,518	$ 166,014		$ 301,532
Improve/Construct Access Roads	$ 27,000	$ 18,000		$ 45,000
Re-Grade Marsh Sediment Areas, Strip Veg, Clear and Grub, Prep for Cover Soil Placement	$ 203,277	$ 249,021		$ 452,298
Load, Haul, Place Vegetative Cover	$ 1,355,178	$ 1,660,140		$ 3,015,318
Seed, Fertilize	$ 55,999	$ 68,601		$ 124,600
Reclaim Cover Soil Borrow Area	$ 83,999	$ 102,901		$ 186,900
Subtotal	$ 1,910,970	$ 2,314,677		$ 4,225,647
Mob/Demob (10%)	$ 191,097	$ 231,468		$ 422,565
Subtotal	$ 2,102,067	$ 2,546,145		$ 4,648,211
Contingencies (15%)	$ 315,310	$ 381,922		$ 697,232
Subtotal	$ 2,417,377	$ 2,928,066		$ 5,345,443
Project Management (5%)	$ 120,869	$ 146,403		$ 267,272
Engineering (6%)	$ 145,043	$ 175,684		$ 320,727
Construction Administration (8%)	$ 193,390	$ 234,245		$ 427,635
Total, Capital Cost	$ 2,876,678	$ 3,484,399		$ 6,361,077
Operations and Maintenance (O & M)				
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 1,250	$ 1,250		$ 2,500
Periodic Repairs - Years 15 and 30 (1/4th remedial cost- re-coversoil, reveg)	$ 392,490	$ 392,490		$ 784,979
Total, 30-yr Present Worth, O & M (3%)	$ 438,125	$ 438,125		$ 876,251
TOTAL CAPITAL COST + O & M	$ 3,314,803	$ 3,922,524		$ 7,237,328
TOTAL EA4 CONTAINMENT COSTS WITH 30-YR PRESENT WORTH O & M				**$ 7,237,328**

EA 4 COST ESTIMATE DETAIL
CONTAINMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 422,564.67	1	$ 422,565	10% of construction cost
Permitting	LS	$ 40,000.00	1	$ 40,000	Engineer Estimate
Surface Water and Sediment Control	LS	$ 60,000.00	1	$ 60,000	Engineer Estimate
Dewatering - Total	CY	$ 1.50	201,021	$ 301,532	Engineer Estimate
Eastern Area	CY	$ 1.50	90,345	$ 135,518	
Western Area	CY	$ 1.50	110,676	$ 166,014	
Improve/Construct Access Roads - Total	LF	$ 18.00	2,500	$ 45,000	Includes Clear/Grub/Log, Reclamation
Eastern Area	LF	$ 18.00	1,500	$ 27,000	
Western Area	LF	$ 18.00	1,000	$ 18,000	
Re-Grade Marsh Sediment Areas, Strip Veg, Clear and Grub, Prep for Cover Soil Placement - Total	SY	$ 1.50	301,532	$ 452,298	Engineer Estimate
Eastern Area	SY	$ 1.50	135,518	$ 203,277	
Western Area	SY	$ 1.50	166,014	$ 249,021	
Load, Haul, Place Vegetative Cover - Total	CY	$ 15.00	201,021	$ 3,015,318	Engineer Estimate
Eastern Area	CY	$ 15.00	90,345	$ 1,355,178	
Western Area	CY	$ 15.00	110,676	$ 1,660,140	
Seed, Fertilize - Total	AC	$ 2,000.00	62.3	$ 124,600	Engineer Estimate
Eastern Area	AC	$ 2,000.00	28.0	$ 55,999	
Western Area	AC	$ 2,000.00	34.3	$ 68,601	
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500.00	41.5	$ 186,900	Engineer Estimate
Eastern Area	AC	$ 4,500.00	18.7	$ 83,999	
Western Area	AC	$ 4,500.00	22.9	$ 102,901	
			Subtotal	$ 4,648,211	
Contingencies		15%		$ 697,231.70	
			Subtotal	$ 5,345,443	
Project Management		5%		$ 267,272	
Engineering		6%		$ 320,727	
Construction Management		8%		$ 427,635	
TOTAL				$ 6,361,077	
			TOTAL CAPITAL COSTS	**$ 6,361,077**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 2,500.00	1	$ 2,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/4th remedial cost- re-coversoil, reveg)	LS	$ 784,979.36	1	$ 784,979	Engineers Estimate
			Subtotal	$ 787,479	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 876,251**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 7,237,328

EA 4 COSTS				
REMOVAL AND ON-SITE DISPOSAL	**Eastern Area**	**Western Area**		**TOTAL**
Permitting	$ 20,000	$ 20,000		$ 40,000
Surface Water and Sediment Control	$ 40,000	$ 40,000		$ 80,000
Dewatering	$ 451,726	$ 553,380		$ 1,005,106
Improve/Construct Access Roads	$ 27,000	$ 18,000		$ 45,000
Excavate, Load, Haul and Place Sediment in Repository	$ 1,355,178	$ 1,660,140		$ 3,015,318
Load, Haul, Place Clean Backfill/Vegetative Cover	$ 677,589	$ 830,070		$ 1,507,659
Revegetate Floodplain Areas	$ 223,996	$ 274,403		$ 498,400
Revegetate Cover Soil Borrow Area	$ 34,999	$ 42,876		$ 77,875
Subtotal	$ 2,830,488	$ 3,438,869		$ 6,269,357
Mob/Demob (10%)	$ 283,049	$ 343,887		$ 626,936
Subtotal	$ 3,113,537	$ 3,782,756		$ 6,896,292
Contingencies (15%)	$ 467,030	$ 567,413		$ 1,034,444
Subtotal	$ 3,580,567	$ 4,350,169		$ 7,930,736
Project Management (5%)	$ 179,028	$ 217,508		$ 396,537
Engineering (6%)	$ 214,834	$ 261,010		$ 475,844
Construction Administration (8%)	$ 286,445	$ 348,014		$ 634,459
Total, Capital Cost	$ 4,260,875	$ 5,176,701		$ 9,437,576
Operations and Maintenance (O & M)				
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	$ 20,000	$ 20,000		$ 40,000
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	$ 7,500	$ 7,500		$ 15,000
Total, 30-yr Present Worth, O & M (3%)	$ 204,250	$ 204,250		$ 408,499
TOTAL CAPITAL COST + O & M	$ 4,465,125	$ 5,380,951		$ 9,846,075
TOTAL EA4 REMOVAL AND ON-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O & M				**$ 9,846,075**

EA4 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 626,935.67	1	$ 626,936	10% of construction cost
Permitting	LS	$ 40,000.00	1	$ 40,000	Engineer Estimate
Surface Water and Sediment Control	LS	$ 80,000.00	1	$ 80,000	Engineer Estimate
Dewatering - Total	CY	$ 5.00	201,021	$ 1,005,106	Engineer Estimate
Eastern Area	CY	$ 5.00	90,345	$ 451,726	
Western Area	CY	$ 5.00	110,676	$ 553,380	
Improve/Construct Access Roads - Total	LF	$ 18.00	2,500	$ 45,000	Includes Clear/Grub/Log, Reclamation
Eastern Area	LF	$ 18.00	1,500	$ 27,000	
Western Area	LF	$ 18.00	1,000	$ 18,000	
Excavate, Load, Haul and Place Sediment in Repository - Total	CY	$ 15.00	201,021	$ 3,015,318	Engineer Estimate
Eastern Area	CY	$ 15.00	90,345	$ 1,355,178	
Western Area	CY	$ 15.00	110,676	$ 1,660,140	
Load, Haul, Place Clean Backfill/Vegetative Cover - Total	CY	$ 15.00	100,511	$ 1,507,659	Not all areas returned to grade
Eastern Area	CY	$ 15.00	45,173	$ 677,589	
Western Area	CY	$ 15.00	55,338	$ 830,070	
Revegetate Floodplain Areas - Total	AC	$ 8,000.00	62	$ 498,400	
Eastern Area	AC	$ 8,000.00	28	$ 223,996	
Western Area	AC	$ 8,000.00	34	$ 274,403	
Revegetate Cover Soil Borrow Area - Total	AC	$ 2,500.00	31.1	$ 77,875	Based on Bald Butte
Eastern Area	AC	$ 2,500.00	14.0	$ 34,999	
Western Area	AC	$ 2,500.00	17.2	$ 42,876	
			Subtotal	$ 6,896,292	
Contingencies		15%		$ 1,034,444	
			Subtotal	$ 7,930,736	
Project Management		5%		$ 396,537	
Engineering		6%		$ 475,844	
Construction Management		8%		$ 634,459	
TOTAL				$ 9,437,576	
			TOTAL CAPITAL COSTS	**$ 9,437,576**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	LS	$ 40,000.00	1	$ 40,000	Engineers Estimate; O & M costs for the Section 35 repository are not included.
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	LS	$ 15,000.00	1	$ 15,000	Engineers Estimate; O & M costs for the Section 35 repository are not included.
			Subtotal	$ 55,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 408,499**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 9,846,075

EA 4 COSTS				
REMOVAL AND OFF-SITE DISPOSAL	**Eastern Area**	**Western Area**		**TOTAL**
Permitting	$ 20,000	$ 20,000		$ 40,000
Surface Water and Sediment Control	$ 40,000	$ 40,000		$ 80,000
Dewatering	$ 451,726	$ 553,380		$ 1,005,106
Improve/Construct Access Roads	$ 27,000	$ 18,000		$ 45,000
Construct Off-site Repository	$ 1,017,286	$ 1,017,286		$ 2,034,571
Excavate, Load, Haul and Place Sediment in Repository	$ 1,355,178	$ 1,660,140		$ 3,015,318
Load, Haul, Place Clean Backfill/Vegetative Cover	$ 677,589	$ 830,070		$ 1,507,659
Revegetate Floodplain Areas	$ 223,996	$ 274,403		$ 498,400
Revegetate Cover Soil Borrow Area	$ 34,999	$ 42,876		$ 77,875
Subtotal	$ 3,847,774	$ 4,456,154		$ 8,303,928
Mob/Demob (10%)	$ 384,777	$ 445,615		$ 830,393
Subtotal	$ 4,232,551	$ 4,901,770		$ 9,134,321
Contingencies (15%)	$ 634,883	$ 735,265		$ 1,370,148
Subtotal	$ 4,867,433	$ 5,637,035		$ 10,504,469
Project Management (5%)	$ 243,372	$ 281,852		$ 525,223
Engineering (6%)	$ 292,046	$ 338,222		$ 630,268
Construction Administration (8%)	$ 389,395	$ 450,963		$ 840,358
Total, Capital Cost	$ 5,792,246	$ 6,708,072		$ 12,500,318
Operations and Maintenance (O & M)				
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	$ 20,000	$ 20,000		$ 40,000
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	$ 7,500	$ 7,500		$ 15,000
Total, 30-yr Present Worth, O & M (3%)	$ 204,250	$ 204,250		$ 408,499
TOTAL CAPITAL COST + O & M	$ 5,996,496	$ 6,912,322		$ 12,908,817
TOTAL EA4 REMOVAL AND OFF-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O & M				**$ 12,908,817**

EA4 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 830,392.80	1	$ 830,393	10% of construction cost
Permitting	LS	$ 40,000.00	1	$ 40,000	Engineer Estimate
Surface Water and Sediment Control	LS	$ 80,000.00	1	$ 80,000	Engineer Estimate
Dewatering - Total	CY	$ 5.00	201,021	$ 1,005,106	Engineer Estimate
Eastern Area	CY	$ 5.00	90,345	$ 451,726	
Western Area	CY	$ 5.00	110,676	$ 553,380	
Improve/Construct Access Roads - Total	LF	$ 18.00	2,500	$ 45,000	Includes Clear/Grub/Log, Reclamation
Eastern Area	LF	$ 18.00	1,500	$ 27,000	
Western Area	LF	$ 18.00	1,000	$ 18,000	
Construct Off-site Repository	CY	$ 10.12	201,021	$ 2,034,571	State Section 18 *
Excavate, Load, Haul and Place Sediment in Repository - Total	CY	$ 15.00	201,021	$ 3,015,318	Engineer Estimate
Eastern Area	CY	$ 15.00	90,345	$ 1,355,178	
Western Area	CY	$ 15.00	110,676	$ 1,660,140	
Load, Haul, Place Clean Backfill/Vegetative Cover - Total	CY	$ 15.00	100,511	$ 1,507,659	Not all areas returned to grade
Eastern Area	CY	$ 15.00	45,173	$ 677,589	
Western Area	CY	$ 15.00	55,338	$ 830,070	
Revegetate Floodplain Areas - Total	AC	$ 8,000.00	62	$ 498,400	
Eastern Area	AC	$ 8,000.00	28	$ 223,996	
Western Area	AC	$ 8,000.00	34	$ 274,403	
Revegetate Cover Soil Borrow Area - Total	AC	$ 2,500.00	31.1	$ 77,875	Based on Bald Butte
Eastern Area	AC	$ 2,500.00	14.0	$ 34,999	
Western Area	AC	$ 2,500.00	17.2	$ 42,876	
			Subtotal	$ 9,134,321	
Contingencies		15%		$ 1,370,148	
			Subtotal	$ 10,504,469	
Project Management		5%		$ 525,223	
Engineering		6%		$ 630,268	
Construction Management		8%		$ 840,358	
TOTAL				$ 12,500,318	
			TOTAL CAPITAL COSTS	**$ 12,500,318**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-5	LS	$ 40,000.00	1	$ 40,000	Engineers Estimate
Site Inspections, Vegetation Maintenance and Repairs, Years 6-30	LS	$ 15,000.00	1	$ 15,000	Engineers Estimate
			Subtotal	$ 55,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 408,499**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 12,908,817

* From the Repository Siting Study for UBMC - State Section 18 Site estimate was $15,034,436 for a 1,000,000 cy repository and includes wastes removed under the EE/CA actions. The total estimated cost included hauling and placement of waste. Construction costs for the repository were $4,048,472. For purposes of this feasibility study, estimated costs from the siting study are scaled to a 400,000 cy repository for a repository construction cost of $10.12/cy.

EA 4 COSTS				
MONITORED NATURAL ATTENUATION	**Eastern Area**	**Western Area**		**TOTAL**
Subtotal	$ -	$ -		$ -
Mob/Demob (10%)	$ -	$ -		$ -
Subtotal	$ -	$ -		$ -
Contingencies (15%)	$ -	$ -		$ -
Subtotal	$ -	$ -		$ -
Project Management (5%)	$ -	$ -		$ -
Engineering (6%)	$ -	$ -		$ -
Construction Administration (8%)	$ -	$ -		$ -
Total Capital Cost	$ -	$ -		$ -
Operations and Maintenance (O & M)				
Semiannual Groundwater Sampling, Analysis and Reporting, Years 1-10	$ 11,000	$ 11,000		$ 22,000
Annual Monitoring Years 11-30	$ 5,500	$ 5,500		$ 11,000
Total, 30-yr Present Worth, O & M (3%)	$ 154,719	$ 154,719		$ 309,437
TOTAL CAPITAL COST + O & M	$ 154,719	$ 154,719		$ 309,437
TOTAL EA4 MNA COSTS WITH 30-YR PRESENT WORTH O & M				**$ 309,437**

EA4 COST ESTIMATE DETAIL
MONITORED NATURAL ATTENUATION - GROUNDWATER*

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Contingencies		15%		$ -	
			Subtotal	$ -	
Project Management		5%		$ -	
Engineering		6%		$ -	
Construction Management		8%		$ -	
TOTAL				$ -	
			TOTAL CAPITAL COSTS	**$ -**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Semiannual Groundwater Sampling, Analysis and Reporting, Years 1-10	LS	$ 22,000.00	1	$ 22,000	Based on current costs and adjusted for 4 wells and semiannual monitoring
Annual Monitoring Years 11-30	LS	$ 11,000.00	1	$ 11,000	Reduce to annual monitoring
			Subtotal	$ 33,000	
			30-YEAR NET PRESENT VALUE ANNUAL O & M COSTS	**$ 309,437**	**Discounted using the rate below**

* Groundwater in the marsh is considered part of EA4 and is evaluated independent of the groundwater for EA2.

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O & M COST) $ 309,437

Groundwater Monitoring	EA	$10,000.00	2	$20,000.00	Existing Annual Budget is ~$65K for GW sitewide. Estimate includes 4 existing wells - EDMW-2, PDGW-101, PMGW-117, LCMW-1. Monitor semiannually.
Analysis and Report	EA	$2,000	1	$2,000.00	
		Annual Cost		$22,000.00	

EA4 - UPPER MARSH - QUANTITY ESTIMATES					
SITE	**SEDIMENT**		**HAUL ROADS**		
	AREA	**VOLUME**	**LENGTH**	**IMPROVE?**	**FENCING**
	(sf)	**(cy)**	**(ft)**		**(ft)**
Eastern Area	1,219,660	90,345	1,500	NEW	0
Western Area	1,494,126	110,676	1,000	NEW	0
	2,713,786	201,021	2,500		
Groundwater Quantity					
Darcy's Law Q= KiA					
K	3.8	ft/day	Well LCMW-1/MPP-4 Pump test from 200		
i	0.0198	ft/ft	Average Hydraulic Gradient from Potenti Map - Figure 21 of the FS		
A	68,900	ft^2	Width = 1300 (avg at middle of Upper Ma		
			Depth = 53' (Well Log BRGW-101 - RI)		
Q	5,184	ft^3/day			
	0.060	cfs			
	26.9	gpm			

Improve/Reconstruct Access Roads

	ft	$/acre	$/sf	$/lf	
width	14				
Clear & Grub		5175	0.1188017	2.00	
Grading/Earthwork				11	Bald Butte
Reclaim				5	
				18.00	

Retention pond

FLOW	0.1	GPM	
VOLUME	52560	CF/YEAR	
AREA	17520	SF	ASSUMING 3' DEPTH
DIMENSIONS			
LENGTH	199		
WIDTH	88		
EXCAVATION VOL	1,298	CY	CUT/FILL BALANCE
ROCK	10	CY	EMERGENCY OVERFLOW
COST			
EXCAV	$12	PER CY	
ROCK	$35	PER CY	
REVEG	$2,500	PER AC	
PER POND	$17,130.00		

TABLE C.4 - CONCEPTUAL COST ESTIMATE STATE SECTION 18 SITE

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Prepare Repository					
Strip and Stockpile Cover Soil and Subsoil	CY	$2.25	65,000	$ 146,250.00	Estimated 2-foot average is available at this site
Prepare Subgrade	SY	$1.00	96,800	$ 96,800.00	Estimated 20 acres
Special Excavation	CY	$9.00	0	$ -	Not required at this site
Load, Haul, Place, and Grade Structural Berm	CY	$25.00	0	$ -	Not required at this site
Install Geocushion	SY	$3.00	0	$ -	Not required at this site
Install Geomembrane	SY	$6.00	0	$ -	Not required at this site
Install Geocomposite Drainage Layer	SY	$4.00	0	$ -	Not required at this site
Install Leachate Collection System	LS	$37,000.00	0	$ -	Not required at this site
Place Tailings and Waste Rock					
Place and Compact Tailings In Repository	CY	$2.25	1,000,000	$ 2,250,000.00	Based on Bald Butte Bid Tabs
Close Repository					
Install Geomembrane Liner	SY	$6.00	96,800	$ 580,800.00	Based on Bald Butte Bid Tabs
Install Geocomposite Cap Drainage Layer	SY	$4.00	96,800	$ 387,200.00	Based on Bald Butte Bid Tabs
Replace Stockpiled Cover Soil	CY	$1.75	65,000	$ 113,750.00	Stockpiled Portion
Place Imported Cover Soil	CY	$1.20	0	$ -	Import From Nora Creek Site
Amend Cover Soil	TON	$350.00	487.5	$ 170,625	Amendment at 3% of top 6 inches of cover soil
Fertilize and Seed	AC	$800.00	20	$ 16,000	Based on Bald Butte Bid Tabs
Haul Roads					
Road Improvement	LF	$6.00	12,000	$ 72,000	Existing road surface upgrade and maintenance
New Road Construction	LF	$10.00	0	$ -	
Misc. Road Improvement	LS	$20,000.00	1	$ 20,000	Miscellaneous small culverts and highway access
Tailings and Borrow Material Haul					
Haul with Back Haul	CY	$ 6.57	400,000	$ 2,627,358	Assuming 400,000 cy of veg borrow required for reclamation
Haul without Back Haul	CY	$ 10.18	600,000	$ 6,108,607	
Back Haul Veg Borrow	CY	$ 3.61	400,000	$ 1,445,047	Assuming 400,000 cy of veg borrow required for reclamation
Excavate Borrow Materials	CY	$ 2.50	400,000	$ 1,000,000	Assuming 400,000 cy of veg borrow required for reclamation
Off-Site Borrow Area Development					
New Road Construction	LF	$10.00	0	$ -	Access to Nora Creek Site
Strip and Stockpile Cover Soil	CY	$2.25	0	$ -	Strip 2 feet from borrow area
Excavate Borrow Materials	CY	$2.50	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Haul Borrow Material	CY	$3.46	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Replace Stockpiled Cover Soil	CY	$1.25	0	$ -	Replace 2 inches of native cover
Fertilize and Seed	Ac	$800.00	0	$ -	Native seed and fertilizer
Other Costs					
Land Acquisition	AC	$1,200.00	0	$ -	Not required at this site
TOTAL				**$ 15,034,436**	

* Cost Estimate taken from UBMC Repository Siting Study (Pioneer, 2011)

$	4,048,472	TOTAL REPOSITORY COST, LESS COST TO HAUL AND PLACE WASTE
$	4.05	PER CUBIC YARD (For 1,000,000 cy repository), LESS COST TO HAUL/PLACE WASTE
	2.50	SCALE FACTOR FOR SMALLER REPOSITORY (1,000,000 cy vs. 400,000 cy) ASSUMING ALL WASTE FROM EA1, EA3, AND EA4.
$	**10.12**	**PER CUBIC YARD (For 400,000 cy repository), LESS COST TO HAUL/PLACE WASTE**

EA 4 COSTS				
SITE WIDE ELEMENT	**Eastern Area**	**Western Area**		**TOTAL**
Institutional Controls	$ 5,000	$ 5,000		**$ 10,000**
Access Restrictions				
Construct Fence	$ -	$ -		**$ -**
Install Gates	$ -	$ -		**$ -**
Install Warning Signs	$ -	$ -		**$ -**
Subtotal	$ -	$ -		**$ -**
Mob/Demob (10%)	$ -	$ -		**$ -**
Subtotal	$ -	$ -		**$ -**
Contingencies (15%)	$ -	$ -		**$ -**
Subtotal	$ -	$ -		**$ -**
Project Management (5%)	$ -	$ -		**$ -**
Engineering (6%)	$ -	$ -		**$ -**
Construction Administration (8%)	$ -	$ -		**$ -**
Total, Access Restrictions	$ -	$ -		**$ -**
Long Term Monitoring & Maintenance				
Site Security, Fence and Sign Maintenance, Years 1-30 (Annual)	$ -	$ -		**$ -**
Periodic Replacement - Years 15 and 30	$ -	$ -		**$ -**
Total, 30-yr Present Worth, Long Term M&M (3%)	$0.00	$0.00		**$ -**
TOTAL SITE-WIDE ELEMENTS WITH 30-YR PRESENT WORTH LONG TERM M&M				**$ 10,000**

TABLE ?? - CONCEPTUAL COST ESTIMATE EA4
SITEWIDE ELEMENTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
INSTITUTIONAL CONTROLS					
Eastern Area	LS	$ 5,000.00	1	$ 5,000	Per DEQ
Western Area	LS	$ 5,000.00	1	$ 5,000	
			TOTAL ICs COSTS	**$ 10,000**	

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
ACCESS RESTRICTIONS					
Mobilization, Bonding, Insurance	LS	$ -	1	$ -	10% of construction cost
Install Farm Fence	LF	$ 5.50	0	$ -	Bald Butte/Great Divide
Eastern Area	LF	$ 5.50	0	$ -	
Western Area	LF	$ 5.50	0	$ -	
Metal Security Gate	EA	$ 1,500.00	0	$ -	Based on Section 35 Bid Tabs
Eastern Area	EA	$ 1,500.00	0	$ -	
Western Area	EA	$ 1,500.00	0	$ -	
Metal Warning Signs	EA	$ 150.00	0	$ -	Engineer Estimate
Eastern Area	EA	$ 150.00	0	$ -	
Western Area	EA	$ 150.00	0	$ -	
			Subtotal	$ -	
Contingencies		15%		$ -	
			Subtotal	$ -	
Project Management		5%		$ -	
Engineering		6%		$ -	
Construction Management		8%		$ -	
TOTAL				$ -	
			TOTAL CAPITAL COSTS	**$ -**	

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Security, Fence and Sign Maintenance, Years 1-30	LS	$ 2,250.00	1	$ 2,250	Engineers Estimate
Periodic Replacement - Years 15 and 30	LS	$ -	1	$ -	1/2 of fence replaced
			Subtotal	$ 2,250	
	30-YEAR NET PRESENT VALUE ANNUAL M&M COSTS			**$ 44,101**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (ICS + ACCESS RESTRICTIONS + m&M COST) $ 54,101

EVALUATION AREA	SITE-WIDE ELEMENTS			REMEDIAL ALTERNATIVE COSTS						
EA 5				No Action	PHYSICAL HAZARDS/SOLID MEDIA					
Mining-related Features					ENGINEERING CONTROLS/LAND DISPOSAL				TREATMENT	
									In-situ	Ex-situ
	ICs	Access Restrictions	Long-term Monitoring and Maintenance		Physical Barriers	Containment	Removal and On-site Disposal	Removal and Off-site Disposal	Neutralization W/Alkaline Amendment	Neutralization W/Alkaline Amendment
AC-01	$0.00	$6,661	$8,211	$0.00	N/A	$67,727	$61,025	$70,069	$51,991	N/A
BR-01, BR-14, BR-16, BR-20 BR-32, BR-39	$0.00	$28,338	$19,716	$0.00	N/A	$464,885	$397,640	$488,383	$306,993	N/A
BR-29	$0.00	$5,645	$7,855	$0.00	N/A	$62,031	$58,278	$63,342	$53,219	N/A
PC-01, PC-21	$0.00	$4,968	$7,618	$0.00	$121,191	N/A	N/A	N/A	N/A	N/A
PC-06, PC-11, PC-22	$0.00	$16,371	$11,609	$0.00	N/A	$229,335	$199,847	$239,639	$160,098	N/A
PBBS	$0.00	N/A	N/A	$0.00	N/A	N/A	N/A	N/A	N/A	N/A
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	$0.00	$23,258	$17,939	$0.00	N/A	$262,891	$218,606	$278,366	$158,909	N/A
PM-26, PM-28	$0.00	$15,129	$11,174	$0.00	N/A	$245,409	$207,129	$258,786	$155,526	N/A
SH-17, SH-23, SH-29, SH-37, SH-43 SH-44	$0.00	$35,338	$22,166	$0.00	N/A	$757,822	$602,074	$812,248	$392,124	N/A
SH-06, SH-07, SH-13, SH-14	$0.00	$30,596	$20,506	$0.00	$65,496	$808,060	$607,411	$878,176	$336,933	N/A
SG-13/14, SG-16, SG-43	$0.00	$22,919	$17,820	$0.00	N/A	$435,417	$346,124	$466,621	$225,754	N/A
SG-24, SG-44, SG-53, SG-55, SG-56 SG-58, SG-67, SG-98	$0.00	$60,063	$35,718	$0.00	N/A	$2,460,763	$1,855,854	$2,672,149	$1,040,427	N/A
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78, SG-82 SG-94, SG-95, SG-96, SG-99	$0.00	$41,209	$43,821	$0.00	N/A	$453,847	$353,603	$488,878	$218,473	N/A
SG-01, SG-31, SG-33, SG-35 SG-86, SG-89	$0.00	$19,984	$21,693	$0.00	$7,158	$250,043	$211,843	$263,392	$160,349	N/A
SWG-02	$0.00	$17,951	$16,082	$0.00	N/A	$52,305	$49,035	$53,448	$44,626	N/A
TOTAL COSTS	**$0**	**$328,430**	**$261,928**	**$0**	**$193,845**	**$6,550,534**	**$5,168,469**	**$7,033,497**	**$3,305,422**	**$0**

EA 5 COSTS																	
	MINING-RELATED FEATURES																
	Anaconda Creek	*Blackfoot River*		*Pass Creek*		*Porcupine Gulch*	*Paymaster Gulch*		*Shave Gulch*		*Stevens Gulch*				*Swamp Gulch*		
SITE-WIDE ELEMENT	**AC-01**	**BR-01, BR-14 BR-16, BR-20 BR-32, BR-39**	**BR-29**	**PC-01, PC-21**	**PC-06, PC-11 PC-22**	**PBBS**	**PM-04, PM-06 PM-12, PM-35 PM-37, JM-01**	**PM-26, PM-28**	**SH-17, SH-23 SH-29, SH-37 SH-43, SH-44**	**SH-06, SH-07 SH-13, SH-14**	**SG-13/14, SG-16 SG-43**	**SG-24, SG-44 SG-53, SG-55 SG-56, SG-58 SG-67, SG-98**	**SG-41, SG-47 SG-48, SG-49/50 SG-51, SG-71 SG-78, SG-82 SG-94, SG-95 SG-96, SG-99**	**SG-01, SG-31 SG-33, SG-35 SG-86, SG-89**	**SWG-01**		**TOTAL**
Access Restrictions																	
Construct Fence	$ 2,775	$ 8,925	$ 2,100	$ -	$ 5,925	$ -	$ 7,200	$ 6,750	$ 13,575	$ 15,375	$ 10,275	$ 26,700	$ 10,875	$ 6,675	$ 10,275		**$ 127,425**
Install Gates	$ 1,500	$ 9,000	$ 1,500	$ 3,000	$ 4,500	$ -	$ 7,500	$ 3,000	$ 9,000	$ 4,500	$ 4,500	$ 12,000	$ 15,000	$ 6,000	$ 1,500		**$ 82,500**
Install Warning Signs	$ 150	$ 900	$ 150	$ 300	$ 450	$ -	$ 750	$ 300	$ 900	$ 450	$ 450	$ 1,200	$ 1,500	$ 600	$ 150		**$ 8,250**
Subtotal	$ 4,425	$ 18,825	$ 3,750	$ 3,300	$ 10,875	$ -	$ 15,450	$ 10,050	$ 23,475	$ 20,325	$ 15,225	$ 39,900	$ 27,375	$ 13,275	$ 11,925		**$ 218,175**
Mob/Demob (10%)	$ 443	$ 1,883	$ 375	$ 330	$ 1,088	$ -	$ 1,545	$ 1,005	$ 2,348	$ 2,033	$ 1,523	$ 3,990	$ 2,738	$ 1,328	$ 1,193		**$ 21,818**
Subtotal	$ 4,868	$ 20,708	$ 4,125	$ 3,630	$ 11,963	$ -	$ 16,995	$ 11,055	$ 25,823	$ 22,358	$ 16,748	$ 43,890	$ 30,113	$ 14,603	$ 13,118		**$ 239,993**
Contingencies (15%)	$ 730	$ 3,106	$ 619	$ 545	$ 1,794	$ -	$ 2,549	$ 1,658	$ 3,873	$ 3,354	$ 2,512	$ 6,584	$ 4,517	$ 2,190	$ 1,968		**$ 35,999**
Subtotal	$ 5,598	$ 23,814	$ 4,744	$ 4,175	$ 13,757	$ -	$ 19,544	$ 12,713	$ 29,696	$ 25,711	$ 19,260	$ 50,474	$ 34,629	$ 16,793	$ 15,085		**$ 275,991**
Project Management (5%)	$ 280	$ 1,191	$ 237	$ 209	$ 688	$ -	$ 977	$ 636	$ 1,485	$ 1,286	$ 963	$ 2,524	$ 1,731	$ 840	$ 754		**$ 13,800**
Engineering (6%)	$ 336	$ 1,429	$ 285	$ 250	$ 825	$ -	$ 1,173	$ 763	$ 1,782	$ 1,543	$ 1,156	$ 3,028	$ 2,078	$ 1,008	$ 905		**$ 16,559**
Construction Administration (8%)	$ 448	$ 1,905	$ 380	$ 334	$ 1,101	$ -	$ 1,564	$ 1,017	$ 2,376	$ 2,057	$ 1,541	$ 4,038	$ 2,770	$ 1,343	$ 1,207		**$ 22,079**
Total, Capital Cost	$ 6,661	$ 28,338	$ 5,645	$ 4,968	$ 16,371	$ -	$ 23,258	$ 15,129	$ 35,338	$ 30,596	$ 22,919	$ 60,063	$ 41,209	$ 19,984	$ 17,951		**$ 328,430**
Long-Term Monitoring and Maintenance (M & M)																	
Site Security, Fence and Sign Maintenance, Years 1-30 (Annual)	$ 300	$ 500	$ 300	$ 300	$ 300	$ -	$ 500	$ 300	$ 500	$ 500	$ 500	$ 750	$ 1,500	$ 750	$ 500		**$ 7,500**
Periodic Replacement - Years 15 and 30	$ 2,213	$ 9,413	$ 1,875	$ 1,650	$ 5,438	$ -	$ 7,725	$ 5,025	$ 11,738	$ 10,163	$ 7,613	$ 19,950	$ 13,688	$ 6,638	$ 5,963		**$ 109,088**
Total, 30-yr Present Worth, Long-Term M&M (3%)	$ 8,211	$ 19,716	$ 7,855	$ 7,618	$ 11,609	$ -	$ 17,939	$ 11,174	$ 22,166	$ 20,506	$ 17,820	$ 35,718	$ 43,821	$ 21,693	$ 16,082		**$ 261,928**
TOTAL EA5 SITE-WIDE ELEMENTS WITH 30-YR PRESENT WORTH LONG-TERM M&M																	**$ 590,358**

EA5 COST ESTIMATE DETAIL
SITE-WIDE ELEMENTS

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
ACCESS RESTRICTIONS					
Mobilization, Bonding, Insurance	LS	$ 21,817.50	1	$ 21,818	10% of construction cost
Install Farm Fence - Total	LF	$ 7.50	16,990	$ 127,425	Based on Bald Butte/Great Divide
AC-01	LF	$ 7.50	370	$ 2,775	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	LF	$ 7.50	1,190	$ 8,925	
BR-29	LF	$ 7.50	280	$ 2,100	
PC-01, PC-21	LF	$ 7.50	0	$ -	
PC-06, PC-11, PC-22	LF	$ 7.50	790	$ 5,925	
PBBS	LF	$ 7.50	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	LF	$ 7.50	960	$ 7,200	
PM-26, PM-28	LF	$ 7.50	900	$ 6,750	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	LF	$ 7.50	1,810	$ 13,575	
SH-06, SH-07, SH-13, SH-14	LF	$ 7.50	2,050	$ 15,375	
SG-13/14, SG-16, SG-43	LF	$ 7.50	1,370	$ 10,275	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	LF	$ 7.50	3,560	$ 26,700	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	LF	$ 7.50	1,450	$ 10,875	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	LF	$ 7.50	890	$ 6,675	
SWG-02	LF	$ 7.50	1,370	$ 10,275	
Metal Security Gate - Total	EA	$ 1,500.00	55	$ 82,500	Based on Section 35 Bid Tabs
AC-01	EA	$ 1,500.00	1	$ 1,500	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	EA	$ 1,500.00	6	$ 9,000	
BR-29	EA	$ 1,500.00	1	$ 1,500	
PC-01, PC-21	EA	$ 1,500.00	2	$ 3,000	
PC-06, PC-11, PC-22	EA	$ 1,500.00	3	$ 4,500	
PBBS	EA	$ 1,500.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	EA	$ 1,500.00	5	$ 7,500	
PM-26, PM-28	EA	$ 1,500.00	2	$ 3,000	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	EA	$ 1,500.00	6	$ 9,000	
SH-06, SH-07, SH-13, SH-14	EA	$ 1,500.00	3	$ 4,500	
SG-13/14, SG-16, SG-43	EA	$ 1,500.00	3	$ 4,500	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	EA	$ 1,500.00	8	$ 12,000	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	EA	$ 1,500.00	10	$ 15,000	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	EA	$ 1,500.00	4	$ 6,000	
SWG-02	EA	$ 1,500.00	1	$ 1,500	
Metal Warning Signs - Total	EA	$ 150.00	55	$ 8,250	Engineer Estimate
AC-01	EA	$ 150.00	1	$ 150	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	EA	$ 150.00	6	$ 900	
BR-29	EA	$ 150.00	1	$ 150	
PC-01, PC-21	EA	$ 150.00	2	$ 300	
PC-06, PC-11, PC-22	EA	$ 150.00	3	$ 450	
PBBS	EA	$ 150.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	EA	$ 150.00	5	$ 750	
PM-26, PM-28	EA	$ 150.00	2	$ 300	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	EA	$ 150.00	6	$ 900	
SH-06, SH-07, SH-13, SH-14	EA	$ 150.00	3	$ 450	
SG-13/14, SG-16, SG-43	EA	$ 150.00	3	$ 450	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	EA	$ 150.00	8	$ 1,200	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	EA	$ 150.00	10	$ 1,500	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	EA	$ 150.00	4	$ 600	
SWG-02	EA	$ 150.00	1	$ 150	
			Subtotal	$ 239,993	
Contingencies		15%		$ 35,998.88	
			Subtotal	$ 275,991	
Project Management		5%		$ 13,799.57	
Engineering		6%		$ 16,559.48	
Construction Management		8%		$ 22,079.31	
TOTAL				$ 328,430	
			TOTAL CAPITAL COSTS	**$ 328,430**	

MONITORING AND MAINTENANCE (M & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Security, Fence and Sign Maintenance, Years 1-30	LS	$ 7,500.00	1	$ 7,500	Engineers Estimate
Periodic Replacement - Years 15 and 30	LS	$ 109,087.50	1	$ 109,088	1/2 of fence replaced
			Subtotal	$ 116,588	
	30-YEAR NET PRESENT VALUE ANNUAL M&M COSTS			**261,965**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (ICS + ACCESS RESTRICTIONS + M&M COST) **$590,395** Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 5 COSTS						
		Pass Creek	***Shave Gulch***	***Stevens Gulch***		**TOTAL**
HYSICAL BARRIER		PC-01, PC-21	SH-06	SG-01		
Install Adit Closure		$ 60,000	$ 30,000	$ -		$ 90,000
Plug Well		$ -	$ -	$ 1,500		$ 1,500
Subtotal		$ 60,000	$ 30,000	$ 1,500		$ 91,500
mob (10%)	10%	$ 6,000	$ 3,000	$ 150		$ 9,150
Subtotal		$ 66,000	$ 33,000	$ 1,650		$ 100,650
ncies (15%)	15%	$ 9,900	$ 4,950	$ 248		$ 15,098
Subtotal		$ 75,900	$ 37,950	$ 1,898		$ 115,748
ement (5%)	5%	$ 3,795	$ 1,898	$ 95		$ 5,787
eering (6%)	6%	$ 4,554	$ 2,277	$ 114		$ 6,945
ration (8%)	8%	$ 6,072	$ 3,036	$ 152		$ 9,260
l, Capital Cost		$ 90,321	$ 45,161	$ 2,258		$ 137,740
Operations and Maintenance (O & M)						
Site Inspection		$ 500	$ 500	$ 250		$ 1,250
Periodic		$ 20,000	$ 10,000	$ -		$ 30,000
	9/16/2014	$ -	$ -	$ -		
	9/16/2029	$ 20,000	$ 10,000	$ -		$ 30,000
	9/12/2044	$ 20,000	$ 10,000	$ -		$ 20,000
Total, 30-yr	3%	$ 30,870	$ 20,335	$ 4,900		$ 56,106
TOTAL CAPITAL COST + O&M		$ 121,191	$ 65,496	$ 7,158		$ 193,845
TOTAL EA5 PHYSICAL BARRIERS COSTS WITH 30-YR PRESENT WORTH O&M						**$ 193,845**

EA5 COST ESTIMATE DETAIL
PHYSICAL BARRIER

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 9,150.00	1	$ 9,150	10% of construction cost
Install Adit Closure	EA	$ 30,000.00	3	$ 90,000	Based on Bald Butte/Great Divide
PC-01, PC-21	EA	$ 30,000.00	2	$ 60,000	Incl. transportation and handling of
SH-06	EA	$ 30,000.00	1	$ 30,000	equipment and materials
Plug Well	EA	$ 1,500.00	1	$ 1,500	Based on Section 35 Bid Tabs
SG-01	EA	$ 1,500.00	1	$ 1,500	
			Subtotal	$ 100,650	
Contingencies		15%		$ 15,098	
			Subtotal	$ 115,748	
Project Management		5%		$ 5,787	
Engineering		6%		$ 6,945	
Construction Management		8%		$ 9,260	
TOTAL				$ 137,740	
			TOTAL CAPITAL COSTS	**$ 137,740**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspection and Maintenance, Years 1-30	LS	$ 1,250.00	1	$ 1,250	Engineers Estimate
Periodic Replacement - Years 15 and 30	LS	$ 30,000.00	1	$ 30,000	Engineers Estimate
			Subtotal	$ 31,250	
	30-YEAR NET PRESENT VALUE ANNUAL O&M COSTS			**$ 56,116**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O&M COST) $ 193,856

Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 5 COSTS																	
	MINING-RELATED FEATURES																
	Anaconda Creek	*Blackfoot River*		*Pass Creek*		*Porcupine Gulch*	*Paymaster Gulch*		*Shave Gulch*		*Stevens Gulch*				*Swamp Gulch*		
CONTAINMENT	**AC-01**	**BR-01, BR-14 BR-16, BR-20 BR-32, BR-39**	**BR-29**	**PC-01, PC-21**	**PC-06, PC-11 PC-22**	**PBBS**	**PM-04, PM-06 PM-12, PM-35 PM-37, JM-01**	**PM-26, PM-28**	**SH-17, SH-23 SH-29, SH-37 SH-43, SH-44**	**SH-06, SH-07 SH-13, SH-14**	**SG-13/14, SG-16 SG-43**	**SG-24, SG-44 SG-53, SG-55 SG-56, SG-58 SG-67, SG-98**	**SG-41, SG-47 SG-48, SG-49/50 SG-51, SG-71 SG-78, SG-82 SG-94, SG-95 SG-96, SG-99**	**SG-01, SG-31 SG-33, SG-35 SG-86, SG-89**	**SWG-01**		**TOTAL**
Improve/Construct Access Roads	$ 27,000	$ 151,200	$ 29,700	$ -	$ 81,000	$ -	$ 67,500	$ 75,600	$ 151,200	$ 89,100	$ 86,400	$ 291,600	$ 64,800	$ 75,600	$ 24,300		$ 1,215,000
Re-Grade Waste Piles, Prep for Cover Soil Placement	$ 3,375	$ 33,865	$ 1,890	$ -	$ 14,850	$ -	$ 22,302	$ 19,278	$ 78,435	$ 101,048	$ 44,969	$ 304,634	$ 50,483	$ 19,238	$ 1,647		$ 696,013
Load, Haul, Place Vegetative Cover	$ 9,000	$ 90,306	$ 5,040	$ -	$ 39,600	$ -	$ 59,472	$ 51,408	$ 209,160	$ 269,460	$ 119,916	$ 812,358	$ 134,622	$ 51,300	$ 4,392		$ 1,856,034
Seed, Fertilize, Mulch	$ 558	$ 5,597	$ 312	$ -	$ 2,455	$ -	$ 3,686	$ 3,186	$ 12,964	$ 16,702	$ 7,433	$ 50,353	$ 8,344	$ 3,180	$ 272		$ 115,043
Reclaim Cover Soil Borrow Area	$ 465	$ 4,665	$ 260	$ -	$ 2,045	$ -	$ 3,072	$ 2,655	$ 10,804	$ 13,918	$ 6,194	$ 41,961	$ 6,954	$ 2,650	$ 227		$ 95,870
Subtotal	$ 40,398	$ 285,633	$ 37,203	$ -	$ 139,950	$ -	$ 156,032	$ 152,128	$ 462,563	$ 490,228	$ 264,911	$ 1,500,906	$ 265,203	$ 151,967	$ 30,838		$ 3,977,960
Mob/Demob (10%)	$ 4,040	$ 28,563	$ 3,720	$ -	$ 13,995	$ -	$ 15,603	$ 15,213	$ 46,256	$ 49,023	$ 26,491	$ 150,091	$ 26,520	$ 15,197	$ 3,084		$ 397,796
Subtotal	$ 44,438	$ 314,196	$ 40,923	$ -	$ 153,945	$ -	$ 171,635	$ 167,341	$ 508,820	$ 539,251	$ 291,402	$ 1,650,996	$ 291,724	$ 167,164	$ 33,922		$ 4,375,756
Contingencies (15%)	$ 6,666	$ 47,129	$ 6,138	$ -	$ 23,092	$ -	$ 25,745	$ 25,101	$ 76,323	$ 80,888	$ 43,710	$ 247,649	$ 43,759	$ 25,075	$ 5,088		$ 656,363
Subtotal	$ 51,103	$ 361,325	$ 47,061	$ -	$ 177,037	$ -	$ 197,381	$ 192,442	$ 585,142	$ 620,138	$ 335,113	$ 1,898,646	$ 335,482	$ 192,238	$ 39,010		$ 5,032,119
Project Management (5%)	$ 2,555	$ 18,066	$ 2,353	$ -	$ 8,852	$ -	$ 9,869	$ 9,622	$ 29,257	$ 31,007	$ 16,756	$ 94,932	$ 16,774	$ 9,612	$ 1,951		$ 251,606
Engineering (6%)	$ 3,066	$ 21,680	$ 2,824	$ -	$ 10,622	$ -	$ 11,843	$ 11,547	$ 35,109	$ 37,208	$ 20,107	$ 113,919	$ 20,129	$ 11,534	$ 2,341		$ 301,927
Construction Administration (8%)	$ 4,088	$ 28,906	$ 3,765	$ -	$ 14,163	$ -	$ 15,790	$ 15,395	$ 46,811	$ 49,611	$ 26,809	$ 151,892	$ 26,839	$ 15,379	$ 3,121		$ 402,570
Total, Capital Cost	$ 60,813	$ 429,977	$ 56,003	$ -	$ 210,674	$ -	$ 234,883	$ 229,006	$ 696,319	$ 737,965	$ 398,784	$ 2,259,388	$ 399,224	$ 228,764	$ 46,422		$ 5,988,222
Operations and Maintenance (O & M)																	
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 750	$ 250	$ -	$ 500	$ -	$ 750	$ 250	$ 750	$ 500	$ 500	$ 1,000	$ 1,250	$ 500	$ 250		$ 7,500
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	$ 1,912	$ 19,181	$ 1,070	$ -	$ 8,411	$ -	$ 12,632	$ 10,919	$ 44,425	$ 57,232	$ 25,470	$ 172,542	$ 28,593	$ 10,896	$ 933		$ 394,215
Total, 30-yr Present Worth, O&M (3%)	$ 6,914	$ 34,907	$ 6,028	$ -	$ 18,661	$ -	$ 28,008	$ 16,403	$ 61,502	$ 70,095	$ 36,633	$ 201,375	$ 54,624	$ 21,279	$ 5,883		$ 562,312
TOTAL CAPITAL COST + O&M	$ 67,727	$ 464,885	$ 62,031	$ -	$ 229,335	$ -	$ 262,891	$ 245,409	$ 757,822	$ 808,060	$ 435,417	$ 2,460,763	$ 453,847	$ 250,043	$ 52,305		$ 6,550,534
TOTAL EA5 CONTAINMENT COSTS WITH 30-YR PRESENT WORTH O&M																	**$ 6,550,534**

EA5 COST ESTIMATE DETAIL
CONTAINMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 397,795.97	1	$ 397,796	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	42,150	$ 1,215,000	Includes Clear/Grub/Log, Reclamation
AC-01	LF	$ 18.00	1,500	$ 27,000	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	LF	$ 18.00	8,400	$ 151,200	
BR-29	LF	$ 18.00	1,650	$ 29,700	
PC-01, PC-21	LF	$ 18.00	0	$ -	
PC-06, PC-11, PC-22	LF	$ 18.00	4,500	$ 81,000	
PBBS	LF	$ 18.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	LF	$ 18.00	3,750	$ 67,500	
PM-26, PM-28	LF	$ 18.00	4,200	$ 75,600	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	LF	$ 18.00	8,400	$ 151,200	
SH-06, SH-07, SH-13, SH-14	LF	$ 18.00	4,950	$ 89,100	
SG-13/14, SG-16, SG-43	LF	$ 18.00	4,800	$ 86,400	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	LF	$ 18.00	16,200	$ 291,600	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	LF	$ 18.00	3,600	$ 64,800	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	LF	$ 18.00	4,200	$ 75,600	
SWG-02	LF	$ 18.00	1,350	$ 24,300	
Re-Grade Waste Piles, Prep for Cover Soil Placement - Total	SY	$ 4.50	71,114	$ 696,013	Engineer Estimate
AC-01	SY	$ 4.50	750	$ 3,375	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	SY	$ 4.50	7,526	$ 33,865	
BR-29	SY	$ 4.50	420	$ 1,890	
PC-01, PC-21	SY	$ 4.50	0	$ -	
PC-06, PC-11, PC-22	SY	$ 4.50	3,300	$ 14,850	
PBBS	SY	$ 4.50	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	SY	$ 4.50	4,956	$ 22,302	
PM-26, PM-28	SY	$ 4.50	4,284	$ 19,278	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	SY	$ 4.50	17,430	$ 78,435	
SH-06, SH-07, SH-13, SH-14	SY	$ 4.50	22,455	$ 101,048	
SG-13/14, SG-16, SG-43	SY	$ 4.50	9,993	$ 44,969	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	SY	$ 4.50	67,697	$ 304,634	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	SY	$ 4.50	11,219	$ 50,483	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	SY	$ 4.50	4,275	$ 19,238	
SWG-02	SY	$ 4.50	366	$ 1,647	
Load, Haul, Place Vegetative Cover - Total	CY	$ 18.00	103,113	$ 1,856,034	Engineer Estimate
AC-01	CY	$ 18.00	500	$ 9,000	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	CY	$ 18.00	5,017	$ 90,306	
BR-29	CY	$ 18.00	280	$ 5,040	
PC-01, PC-21	CY	$ 18.00	0	$ -	
PC-06, PC-11, PC-22	CY	$ 18.00	2,200	$ 39,600	
PBBS	CY	$ 18.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	CY	$ 18.00	3,304	$ 59,472	
PM-26, PM-28	CY	$ 18.00	2,856	$ 51,408	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	CY	$ 18.00	11,620	$ 209,160	
SH-06, SH-07, SH-13, SH-14	CY	$ 18.00	14,970	$ 269,460	
SG-13/14, SG-16, SG-43	CY	$ 18.00	6,662	$ 119,916	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	CY	$ 18.00	45,131	$ 812,358	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	CY	$ 18.00	7,479	$ 134,622	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	CY	$ 18.00	2,850	$ 51,300	
SWG-02	CY	$ 18.00	244	$ 4,392	

EA5 COST ESTIMATE DETAIL
CONTAINMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 3,000	38.3	$ 115,043	Engineer Estimate
AC-01	AC	$ 3,000	0.2	$ 558	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 3,000	1.9	$ 5,597	
BR-29	AC	$ 3,000	0.1	$ 312	
PC-01, PC-11	AC	$ 3,000	0.0	$ -	
PC-21, PC-11, PC-22	AC	$ 3,000	0.8	$ 2,455	
PBBS	AC	$ 3,000	0.0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 3,000	1.2	$ 3,686	
PM-26, PM-28	AC	$ 3,000	1.1	$ 3,186	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 3,000	4.3	$ 12,964	
SH-06, SH-07, SH-13, SH-14	AC	$ 3,000	5.6	$ 16,702	
SG-13/14, SG-16, SG-43	AC	$ 3,000	2.5	$ 7,433	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 3,000	16.8	$ 50,353	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 3,000	2.8	$ 8,344	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 3,000	1.1	$ 3,180	
SWG-02	AC	$ 3,000	0.1	$ 272	
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500	21.3	$ 95,870	Engineer Estimate
AC-01	AC	$ 4,500	0.1	$ 465	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 4,500	1.0	$ 4,665	
BR-29	AC	$ 4,500	0.1	$ 260	
PC-01, PC-21	AC	$ 4,500	0.0	$ -	
PC-06, PC-11, PC-22	AC	$ 4,500	0.5	$ 2,045	
PBBS	AC	$ 4,500	0.0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 4,500	0.7	$ 3,072	
PM-26, PM-28	AC	$ 4,500	0.6	$ 2,655	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 4,500	2.4	$ 10,804	
SH-06, SH-07, SH-13, SH-14	AC	$ 4,500	3.1	$ 13,918	
SG-13/14, SG-16, SG-43	AC	$ 4,500	1.4	$ 6,194	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 4,500	9.3	$ 41,961	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 4,500	1.5	$ 6,954	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 4,500	0.6	$ 2,650	
SWG-02	AC	$ 4,500	0.1	$ 227	
			Subtotal	$ 4,375,756	
Contingencies		15%		$ 656,363	
			Subtotal	$ 5,032,119	
Project Management		5%		$ 251,606	
Engineering		6%		$ 301,927	
Construction Management		8%		$ 402,570	
TOTAL				$ 5,988,222	
			TOTAL CAPITAL COSTS	**$ 5,988,222**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 7,500.00	1	$ 7,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/5th remedial cost- re-coversoil, reveg)	LS	$ 394,215.49	1	$ 394,215	Engineers Estimate
			Subtotal	$ 401,715	
			30-YEAR NET PRESENT VALUE ANNUAL O&M COSTS	**$ 562,447**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O&M COST) $ 6,550,668 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 5 COSTS																	
	MINING-RELATED FEATURES																
	Anaconda Creek	*Blackfoot River*		*Pass Creek*		*Porcupine Gulch*	*Paymaster Gulch*		*Shave Gulch*		*Stevens Gulch*				*Swamp Gulch*		
REMOVAL AND ON-SITE DISPOSAL	**AC-01**	**BR-01, BR-14 BR-16, BR-20 BR-32, BR-39**	**BR-29**	**PC-01, PC-21**	**PC-06, PC-11 PC-22**	**PBBS**	**PM-04, PM-06 PM-12, PM-35 PM-37, JM-01**	**PM-26, PM-28**	**SH-17, SH-23 SH-29, SH-37 SH-43, SH-44**	**SH-06, SH-07 SH-13, SH-14**	**SG-13/14, SG-16 SG-43**	**SG-24, SG-44 SG-53, SG-55 SG-56, SG-58 SG-67, SG-98**	**SG-41, SG-47 SG-48, SG-49/50 SG-51, SG-71 SG-78, SG-82 SG-94, SG-95 SG-96, SG-99**	**SG-01, SG-31 SG-33, SG-35 SG-86, SG-89**	**SWG-01**		**TOTAL**
Improve/Construct Access Roads	$ 27,000	$ 151,200	$ 29,700	$ -	$ 81,000	$ -	$ 67,500	$ 75,600	$ 151,200	$ 89,100	$ 86,400	$ 291,600	$ 64,800	$ 75,600	$ 24,300		$ 1,215,000
Excavate, Load, Haul and Place Waste in Repository	$ 7,500	$ 75,255	$ 4,200	$ -	$ 33,000	$ -	$ 49,560	$ 42,840	$ 174,300	$ 224,550	$ 99,930	$ 676,965	$ 112,185	$ 42,750	$ 3,660		$ 1,546,695
Load, Haul, Place Vegetative Cover	$ 1,875	$ 18,814	$ 1,050	$ -	$ 8,250	$ -	$ 12,390	$ 10,710	$ 43,575	$ 56,138	$ 24,983	$ 169,241	$ 28,046	$ 10,688	$ 915		$ 386,674
Seed, Fertilize, Mulch	$ 465	$ 4,665	$ 260	$ -	$ 2,045	$ -	$ 3,072	$ 2,655	$ 10,804	$ 13,918	$ 6,194	$ 41,961	$ 6,954	$ 2,650	$ 227		$ 95,870
Reclaim Cover Soil Borrow Area	$ 116	$ 1,166	$ 65	$ -	$ 511	$ -	$ 768	$ 664	$ 2,701	$ 3,480	$ 1,549	$ 10,490	$ 1,738	$ 662	$ 57		$ 23,967
Subtotal	$ 36,956	$ 251,099	$ 35,275	$ -	$ 124,807	$ -	$ 133,290	$ 132,469	$ 382,580	$ 387,185	$ 219,055	$ 1,190,257	$ 213,723	$ 132,350	$ 29,159		$ 3,268,206
Mob/Demob (10%)	$ 3,696	$ 25,110	$ 3,528	$ -	$ 12,481	$ -	$ 13,329	$ 13,247	$ 38,258	$ 38,719	$ 21,906	$ 119,026	$ 21,372	$ 13,235	$ 2,916		$ 326,821
Subtotal	$ 40,652	$ 276,209	$ 38,803	$ -	$ 137,288	$ -	$ 146,619	$ 145,716	$ 420,838	$ 425,904	$ 240,961	$ 1,309,283	$ 235,096	$ 145,585	$ 32,074		$ 3,595,026
Contingencies (15%)	$ 6,098	$ 41,431	$ 5,820	$ -	$ 20,593	$ -	$ 21,993	$ 21,857	$ 63,126	$ 63,886	$ 36,144	$ 196,392	$ 35,264	$ 21,838	$ 4,811		$ 539,254
Subtotal	$ 46,749	$ 317,641	$ 44,623	$ -	$ 157,881	$ -	$ 168,612	$ 167,574	$ 483,963	$ 489,790	$ 277,105	$ 1,505,675	$ 270,360	$ 167,422	$ 36,886		$ 4,134,280
Project Management (5%)	$ 2,337	$ 15,882	$ 2,231	$ -	$ 7,894	$ -	$ 8,431	$ 8,379	$ 24,198	$ 24,489	$ 13,855	$ 75,284	$ 13,518	$ 8,371	$ 1,844		$ 206,714
Engineering (6%)	$ 2,805	$ 19,058	$ 2,677	$ -	$ 9,473	$ -	$ 10,117	$ 10,054	$ 29,038	$ 29,387	$ 16,626	$ 90,341	$ 16,222	$ 10,045	$ 2,213		$ 248,057
Construction Administration (8%)	$ 3,740	$ 25,411	$ 3,570	$ -	$ 12,630	$ -	$ 13,489	$ 13,406	$ 38,717	$ 39,183	$ 22,168	$ 120,454	$ 21,629	$ 13,394	$ 2,951		$ 330,742
Total, Capital Cost	$ 55,632	$ 377,993	$ 53,102	$ -	$ 187,878	$ -	$ 200,648	$ 199,413	$ 575,916	$ 582,850	$ 329,754	$ 1,791,753	$ 321,728	$ 199,233	$ 43,894		$ 4,919,793
Operations and Maintenance (O & M)																	
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 750	$ 250	$ -	$ 500	$ -	$ 750	$ 250	$ 750	$ 500	$ 500	$ 1,000	$ 1,250	$ 500	$ 250		$ 7,500
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	$ 468	$ 4,696	$ 262	$ -	$ 2,059	$ -	$ 3,092	$ 2,673	$ 10,876	$ 14,011	$ 6,235	$ 42,240	$ 7,000	$ 2,667	$ 228		$ 96,509
Total, 30-yr Present Worth, O&M (3%)	$ 5,393	$ 19,647	$ 5,176	$ -	$ 11,969	$ -	$ 17,958	$ 7,716	$ 26,158	$ 24,561	$ 16,369	$ 64,101	$ 31,875	$ 12,610	$ 5,141		$ 248,676
TOTAL CAPITAL COST + O&M	$ 61,025	$ 397,640	$ 58,278	$ -	$ 199,847	$ -	$ 218,606	$ 207,129	$ 602,074	$ 607,411	$ 346,124	$ 1,855,854	$ 353,603	$ 211,843	$ 49,035		$ 5,168,469
TOTAL EA5 REMOVAL AND ON-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O&M																	**$ 5,168,469**

EA5 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 326,820.57	1	$ 326,821	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	42,150	$ 1,215,000	Includes Clear/Grub/Log, Reclamation
AC-01	LF	$ 18.00	1,500	$ 27,000	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	LF	$ 18.00	8,400	$ 151,200	
BR-29	LF	$ 18.00	1,650	$ 29,700	
PC-01, PC-21	LF	$ 18.00	0	$ -	
PC-06, PC-11, PC-22	LF	$ 18.00	4,500	$ 81,000	
PBBS	LF	$ 18.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	LF	$ 18.00	3,750	$ 67,500	
PM-26, PM-28	LF	$ 18.00	4,200	$ 75,600	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	LF	$ 18.00	8,400	$ 151,200	
SH-06, SH-07, SH-13, SH-14	LF	$ 18.00	4,950	$ 89,100	
SG-13/14, SG-16, SG-43	LF	$ 18.00	4,800	$ 86,400	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	LF	$ 18.00	16,200	$ 291,600	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	LF	$ 18.00	3,600	$ 64,800	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	LF	$ 18.00	4,200	$ 75,600	
SWG-02	LF	$ 18.00	1,350	$ 24,300	
Excavate, Load, Haul and Place Waste in Repository - Total	CY	$ 15.00	47,409	$ 1,546,695	Engineer Estimate
AC-01	CY	$ 15.00	500	$ 7,500	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	CY	$ 15.00	5,017	$ 75,255	
BR-29	CY	$ 15.00	280	$ 4,200	
PC-01, PC-21	CY	$ 15.00	0	$ -	
PC-06, PC-11, PC-22	CY	$ 15.00	2,200	$ 33,000	
PBBS	CY	$ 15.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	CY	$ 15.00	3,304	$ 49,560	
PM-26, PM-28	CY	$ 15.00	2,856	$ 42,840	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	CY	$ 15.00	11,620	$ 174,300	
SH-06, SH-07, SH-13, SH-14	CY	$ 15.00	14,970	$ 224,550	
SG-13/14, SG-16, SG-43	CY	$ 15.00	6,662	$ 99,930	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	CY	$ 15.00	45,131	$ 676,965	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	CY	$ 15.00	7,479	$ 112,185	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	CY	$ 15.00	2,850	$ 42,750	
SWG-02	CY	$ 15.00	244	$ 3,660	
Load, Haul, Place Vegetative Cover - Total	CY	$ 15.00	11,852	$ 386,674	6 inch cover imported over removal areas
AC-01	CY	$ 15.00	125	$ 1,875	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	CY	$ 15.00	1,254	$ 18,814	
BR-29	CY	$ 15.00	70	$ 1,050	
PC-01, PC-21	CY	$ 15.00	0	$ -	
PC-06, PC-11, PC-22	CY	$ 15.00	550	$ 8,250	
PBBS	CY	$ 15.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	CY	$ 15.00	826	$ 12,390	
PM-26, PM-28	CY	$ 15.00	714	$ 10,710	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	CY	$ 15.00	2,905	$ 43,575	
SH-06, SH-07, SH-13, SH-14	CY	$ 15.00	3,743	$ 56,138	
SG-13/14, SG-16, SG-43	CY	$ 15.00	1,666	$ 24,983	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	CY	$ 15.00	11,283	$ 169,241	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	CY	$ 15.00	1,870	$ 28,046	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	CY	$ 15.00	713	$ 10,688	
SWG-02	CY	$ 15.00	61	$ 915	
Seed, Fertilize, Mulch - Total	AC	$ 3,000	14.7	$ 95,870	Based on Bald Butte
AC-01	AC	$ 3,000	0.2	$ 465	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 3,000	1.6	$ 4,665	
BR-29	AC	$ 3,000	0.1	$ 260	
PC-01, PC-21	AC	$ 3,000	0.0	$ -	
PC-06, PC-11, PC-22	AC	$ 3,000	0.7	$ 2,045	

EA5 COST ESTIMATE DETAIL
REMOVAL AND ON-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
PBBS	AC	$ 3,000	0.0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 3,000	1.0	$ 3,072	
PM-26, PM-28	AC	$ 3,000	0.9	$ 2,655	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 3,000	3.6	$ 10,804	
SH-06, SH-07, SH-13, SH-14	AC	$ 3,000	4.6	$ 13,918	
SG-13/14, SG-16, SG-43	AC	$ 3,000	2.1	$ 6,194	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 3,000	14.0	$ 41,961	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 3,000	2.3	$ 6,954	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 3,000	0.9	$ 2,650	
SWG-02	AC	$ 3,000	0.1	$ 227	
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500	2.4	$ 23,967	Based on Bald Butte
AC-01	AC	$ 4,500	0.0	$ 116	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 4,500	0.3	$ 1,166	
BR-29	AC	$ 4,500	0.0	$ 65	
PC-01, PC-21	AC	$ 4,500	0.0	$ -	
PC-06, PC-11, PC-22	AC	$ 4,500	0.1	$ 511	
PBBS	AC	$ 4,500	0.0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 4,500	0.2	$ 768	
PM-26, PM-28	AC	$ 4,500	0.1	$ 664	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 4,500	0.6	$ 2,701	
SH-06, SH-07, SH-13, SH-14	AC	$ 4,500	0.8	$ 3,480	
SG-13/14, SG-16, SG-43	AC	$ 4,500	0.3	$ 1,549	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 4,500	2.3	$ 10,490	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 4,500	0.4	$ 1,738	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 4,500	0.1	$ 662	
SWG-02	AC	$ 4,500	0.0	$ 57	
			Subtotal	$ 3,595,026	
Contingencies		15%		$ 539,254	
			Subtotal	$ 4,134,280	
Project Management		5%		$ 206,714	
Engineering		6%		$ 248,057	
Construction Management		8%		$ 330,742	
TOTAL				$ 4,919,793	
			TOTAL CAPITAL COSTS	**$ 4,919,793**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 7,500.00	1	$ 7,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	LS	$ 96,508.65	1	$ 96,509	Engineers Estimate
			Subtotal	$ 104,009	
			30-YEAR NET PRESENT VALUE ANNUAL O&M COSTS	**$ 248,709**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O&M COST) $ 5,168,502

Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 5 COSTS																	
	MINING-RELATED FEATURES																
	Anaconda Creek	*Blackfoot River*		*Pass Creek*		*Porcupine Gulch*	*Paymaster Gulch*		*Shave Gulch*		*Stevens Gulch*				*Swamp Gulch*		
REMOVAL AND OFF-SITE DISPOSAL	**AC-01**	**BR-01, BR-14 BR-16, BR-20 BR-32, BR-39**	**BR-29**	**PC-01, PC-21**	**PC-06, PC-11 PC-22**	**PBBS**	**PM-04, PM-06 PM-12, PM-35 PM-37, JM-01**	**PM-26, PM-28**	**SH-17, SH-23 SH-29, SH-37 SH-43, SH-44**	**SH-06, SH-07 SH-13, SH-14**	**SG-13/14, SG-16 SG-43**	**SG-24, SG-44 SG-53, SG-55 SG-56, SG-58 SG-67, SG-98**	**SG-41, SG-47 SG-48, SG-49/50 SG-51, SG-71 SG-78, SG-82 SG-94, SG-95 SG-96, SG-99**	**SG-01, SG-31 SG-33, SG-35 SG-86, SG-89**	**SWG-01**		**TOTAL**
Construct Off-site Repository	$ 5,061	$ 50,778	$ 2,834	$ -	$ 22,267	$ -	$ 33,440	$ 28,906	$ 117,608	$ 151,514	$ 67,427	$ 456,779	$ 75,696	$ 28,845	$ 2,470		$ 1,043,625
Improve/Construct Access Roads	$ 27,000	$ 151,200	$ 29,700	$ -	$ 81,000	$ -	$ 67,500	$ 75,600	$ 151,200	$ 89,100	$ 86,400	$ 291,600	$ 64,800	$ 75,600	$ 24,300		$ 1,215,000
Excavate, Load, Haul and Place Waste in Repository	$ 7,500	$ 75,255	$ 4,200	$ -	$ 33,000	$ -	$ 49,560	$ 42,840	$ 174,300	$ 224,550	$ 99,930	$ 676,965	$ 112,185	$ 42,750	$ 3,660		$ 1,546,695
Load, Haul, Place Vegetative Cover	$ 1,875	$ 18,814	$ 1,050	$ -	$ 8,250	$ -	$ 12,390	$ 10,710	$ 43,575	$ 56,138	$ 24,983	$ 169,241	$ 28,046	$ 10,688	$ 915		$ 386,674
Seed, Fertilize, Mulch	$ 465	$ 4,665	$ 260	$ -	$ 2,045	$ -	$ 3,072	$ 2,655	$ 10,804	$ 13,918	$ 6,194	$ 41,961	$ 6,954	$ 2,650	$ 227		$ 95,870
Reclaim Cover Soil Borrow Area	$ 116	$ 1,166	$ 65	$ -	$ 511	$ -	$ 768	$ 664	$ 2,701	$ 3,480	$ 1,549	$ 10,490	$ 1,738	$ 662	$ 57		$ 23,967
Subtotal	$ 42,017	$ 301,877	$ 38,109	$ -	$ 147,073	$ -	$ 166,730	$ 161,375	$ 500,188	$ 538,700	$ 286,482	$ 1,647,036	$ 289,420	$ 161,195	$ 31,628		$ 4,311,831
Mob/Demob (10%)	$ 4,202	$ 30,188	$ 3,811	$ -	$ 14,707	$ -	$ 16,673	$ 16,138	$ 50,019	$ 53,870	$ 28,648	$ 164,704	$ 28,942	$ 16,120	$ 3,163		$ 431,183
Subtotal	$ 46,218	$ 332,065	$ 41,920	$ -	$ 161,781	$ -	$ 183,403	$ 177,513	$ 550,207	$ 592,569	$ 315,131	$ 1,811,740	$ 318,362	$ 177,315	$ 34,791		$ 4,743,014
Contingencies (15%)	$ 6,933	$ 49,810	$ 6,288	$ -	$ 24,267	$ -	$ 27,510	$ 26,627	$ 82,531	$ 88,885	$ 47,270	$ 271,761	$ 47,754	$ 26,597	$ 5,219		$ 711,452
Subtotal	$ 53,151	$ 381,875	$ 48,208	$ -	$ 186,048	$ -	$ 210,914	$ 204,140	$ 632,738	$ 681,455	$ 362,400	$ 2,083,501	$ 366,116	$ 203,912	$ 40,010		$ 5,454,466
Project Management (5%)	$ 2,658	$ 19,094	$ 2,410	$ -	$ 9,302	$ -	$ 10,546	$ 10,207	$ 31,637	$ 34,073	$ 18,120	$ 104,175	$ 18,306	$ 10,196	$ 2,000		$ 272,723
Engineering (6%)	$ 3,189	$ 22,912	$ 2,892	$ -	$ 11,163	$ -	$ 12,655	$ 12,248	$ 37,964	$ 40,887	$ 21,744	$ 125,010	$ 21,967	$ 12,235	$ 2,401		$ 327,268
Construction Administration (8%)	$ 4,252	$ 30,550	$ 3,857	$ -	$ 14,884	$ -	$ 16,873	$ 16,331	$ 50,619	$ 54,516	$ 28,992	$ 166,680	$ 29,289	$ 16,313	$ 3,201		$ 436,357
Total, Capital Cost	$ 63,250	$ 454,431	$ 57,368	$ -	$ 221,397	$ -	$ 250,987	$ 242,926	$ 752,958	$ 810,931	$ 431,256	$ 2,479,366	$ 435,678	$ 242,655	$ 47,611		$ 6,490,815
Operations and Maintenance (O & M)																	
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 750	$ 250	$ -	$ 500	$ -	$ 750	$ 250	$ 750	$ 500	$ 500	$ 1,000	$ 1,250	$ 500	$ 250		$ 7,500
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	$ 468	$ 4,696	$ 262	$ -	$ 2,059	$ -	$ 3,092	$ 2,673	$ 10,876	$ 14,011	$ 6,235	$ 42,240	$ 7,000	$ 2,667	$ 228		$ 96,509
Off-site Repository O&M and Repairs, Years 1-30	$ 73	$ 730	$ 41	$ -	$ 320	$ -	$ 481	$ 415	$ 1,690	$ 2,178	$ 969	$ 6,565	$ 1,088	$ 415	$ 35		$ 15,000
Total, 30-yr Present Worth, O&M (3%)	$ 6,819	$ 33,952	$ 5,975	$ -	$ 18,242	$ -	$ 27,379	$ 15,860	$ 59,290	$ 67,245	$ 35,365	$ 192,783	$ 53,200	$ 20,737	$ 5,836		$ 542,683
TOTAL CAPITAL COST + O&M	$ 70,069	$ 488,383	$ 63,342	$ -	$ 239,639	$ -	$ 278,366	$ 258,786	$ 812,248	$ 878,176	$ 466,621	$ 2,672,149	$ 488,878	$ 263,392	$ 53,448		$ 7,033,497
TOTAL EA5 REMOVAL AND OFF-SITE DISPOSAL COSTS WITH 30-YR PRESENT WORTH O&M																	**$ 7,033,497**

EA5 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 431,183.08	1	$ 431,183	10% of construction cost
Construct Off-site Repository - Total		$ 10.12	47,409	$ 1,043,625	State Section 18*
AC-01	CY	$ 10.12	500	$ 5,061	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	CY	$ 10.12	5,017	$ 50,778	
BR-29	CY	$ 10.12	280	$ 2,834	
PC-01, PC-21	CY	$ 10.12	0	$ -	
PC-06, PC-11, PC-22	CY	$ 10.12	2,200	$ 22,267	
PBBS	CY	$ 10.12	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	CY	$ 10.12	3,304	$ 33,440	
PM-26, PM-28	CY	$ 10.12	2,856	$ 28,906	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	CY	$ 10.12	11,620	$ 117,608	
SH-06, SH-07, SH-13, SH-14	CY	$ 10.12	14,970	$ 151,514	
SG-13/14, SG-16, SG-43	CY	$ 10.12	6,662	$ 67,427	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	CY	$ 10.12	45,131	$ 456,779	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	CY	$ 10.12	7,479	$ 75,696	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	CY	$ 10.12	2,850	$ 28,845	
SWG-02	CY	$ 10.12	244	$ 2,470	
Improve/Construct Access Roads - Total	LF	$ 18.00	42,150	$ 1,215,000	Includes Clear/Grub/Log, Reclamation
AC-01	LF	$ 18.00	1,500	$ 27,000	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	LF	$ 18.00	8,400	$ 151,200	
BR-29	LF	$ 18.00	1,650	$ 29,700	
PC-01, PC-11	LF	$ 18.00	0	$ -	
PC-21, PC-11, PC-22	LF	$ 18.00	4,500	$ 81,000	
PBBS	LF	$ 18.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	LF	$ 18.00	3,750	$ 67,500	
PM-26, PM-28	LF	$ 18.00	4,200	$ 75,600	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	LF	$ 18.00	8,400	$ 151,200	
SH-06, SH-07, SH-13, SH-14	LF	$ 18.00	4,950	$ 89,100	
SG-13/14, SG-16, SG-43	LF	$ 18.00	4,800	$ 86,400	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	LF	$ 18.00	16,200	$ 291,600	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	LF	$ 18.00	3,600	$ 64,800	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	LF	$ 18.00	4,200	$ 75,600	
SWG-02	LF	$ 18.00	1,350	$ 24,300	
Excavate, Load, Haul and Place Waste in Repository - Total	CY	$ 15.00	47,409	$ 1,546,695	Engineer Estimate
AC-01	CY	$ 15.00	500	$ 7,500	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	CY	$ 15.00	5,017	$ 75,255	
BR-29	CY	$ 15.00	280	$ 4,200	
PC-01, PC-21	CY	$ 15.00	0	$ -	
PC-06, PC-11, PC-22	CY	$ 15.00	2,200	$ 33,000	
PBBS	CY	$ 15.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	CY	$ 15.00	3,304	$ 49,560	
PM-26, PM-28	CY	$ 15.00	2,856	$ 42,840	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	CY	$ 15.00	11,620	$ 174,300	
SH-06, SH-07, SH-13, SH-14	CY	$ 15.00	14,970	$ 224,550	
SG-13/14, SG-16, SG-43	CY	$ 15.00	6,662	$ 99,930	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	CY	$ 15.00	45,131	$ 676,965	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	CY	$ 15.00	7,479	$ 112,185	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	CY	$ 15.00	2,850	$ 42,750	
SWG-02	CY	$ 15.00	244	$ 3,660	

EA5 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Load, Haul, Place Vegetative Cover - Total	CY	$ 15.00	11,852	$ 386,674	6 inch cover imported over removal areas
AC-01	CY	$ 15.00	125	$ 1,875	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	CY	$ 15.00	1,254	$ 18,814	
BR-29	CY	$ 15.00	70	$ 1,050	
PC-01, PC-21	CY	$ 15.00	0	$ -	
PC-06, PC-11, PC-22	CY	$ 15.00	550	$ 8,250	
PBBS	CY	$ 15.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	CY	$ 15.00	826	$ 12,390	
PM-26, PM-28	CY	$ 15.00	714	$ 10,710	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	CY	$ 15.00	2,905	$ 43,575	
SH-06, SH-07, SH-13, SH-14	CY	$ 15.00	3,743	$ 56,138	
SG-13/14, SG-16, SG-43	CY	$ 15.00	1,666	$ 24,983	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	CY	$ 15.00	11,283	$ 169,241	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78, SG-82 SG-94, SG-95, SG-96, SG-99	CY	$ 15.00	1,870	$ 28,046	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	CY	$ 15.00	713	$ 10,688	
SWG-02	CY	$ 15.00	61	$ 915	
Seed, Fertilize, Mulch - Total	AC	$ 3,000.00	14.7	$ 95,870	Based on Bald Butte
AC-01	AC	$ 3,000.00	0.2	$ 465	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 3,000.00	1.6	$ 4,665	
BR-29	AC	$ 3,000.00	0.1	$ 260	
PC-01, PC-21	AC	$ 3,000.00	0.0	$ -	
PC-06, PC-11, PC-22	AC	$ 3,000.00	0.7	$ 2,045	
PBBS	AC	$ 3,000.00	0.0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 3,000.00	1.0	$ 3,072	
PM-26, PM-28	AC	$ 3,000.00	0.9	$ 2,655	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 3,000.00	3.6	$ 10,804	
SH-06, SH-07, SH-13, SH-14	AC	$ 3,000.00	4.6	$ 13,918	
SG-13/14, SG-16, SG-43	AC	$ 3,000.00	2.1	$ 6,194	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 3,000.00	14.0	$ 41,961	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 3,000.00	2.3	$ 6,954	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 3,000.00	0.9	$ 2,650	
SWG-02	AC	$ 3,000.00	0.1	$ 227	
Reclaim Cover Soil Borrow Area - Total	AC	$ 4,500.00	2.4	$ 23,967	Bald Butte
AC-01	AC	$ 4,500.00	0.0	$ 116	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 4,500.00	0.3	$ 1,166	
BR-29	AC	$ 4,500.00	0.0	$ 65	
PC-01, PC-21	AC	$ 4,500.00	0.0	$ -	
PC-06, PC-11, PC-22	AC	$ 4,500.00	0.1	$ 511	
PBBS	AC	$ 4,500.00	0.0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 4,500.00	0.2	$ 768	
PM-26, PM-28	AC	$ 4,500.00	0.1	$ 664	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 4,500.00	0.6	$ 2,701	
SH-06, SH-07, SH-13, SH-14	AC	$ 4,500.00	0.8	$ 3,480	
SG-13/14, SG-16, SG-43	AC	$ 4,500.00	0.3	$ 1,549	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 4,500.00	2.3	$ 10,490	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 4,500.00	0.4	$ 1,738	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 4,500.00	0.1	$ 662	
SWG-02	AC	$ 4,500.00	0.0	$ 57	
			Subtotal	$ 4,743,014	

EA5 COST ESTIMATE DETAIL
REMOVAL AND OFF-SITE DISPOSAL

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Contingencies		15%		$ 711,452	
			Subtotal	$ 5,454,466	
Project Management		5%		$ 272,723	
Engineering		6%		$ 327,268	
Construction Management		8%		$ 436,357	
TOTAL				$ 6,490,815	
			TOTAL CAPITAL COSTS	**$ 6,490,815**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 7,500.00	1	$ 7,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	LS	$ 96,508.65	1	$ 96,509	Engineers Estimate
Off-site Repository O&M and Repairs, Years 1-30	LS	$ 15,000.00	1	$ 15,000	Engineers Estimate
			Subtotal	$ 104,009	
			30-YEAR NET PRESENT VALUE ANNUAL O&M COSTS	**$ 542,715**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O&M COST) $ 7,033,530 Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

* From the Repository Siting Study for UBMC - State Section 18 Site estimate was $15,034,436 for a 1,000,000 cy repository and includes wastes removed under the EE/CA actions. The total estimated cost included hauling and placement of waste. Construction costs for the repository were $4,048,472. For purposes of this feasibility study, estimated costs from the siting study are scaled to a 400,000 cy repository for a repository construction cost of $10.12/cy.

EA 5 COSTS																	
	MINING-RELATED FEATURES																
	Anaconda Creek	*Blackfoot River*		*Pass Creek*		*Porcupine Gulch*	*Paymaster Gulch*		*Shave Gulch*		*Stevens Gulch*				*Swamp Gulch*		
IN-SITU NEUTRALIZATION WITH LIME	**AC-01**	**BR-01, BR-14 BR-16, BR-20 BR-32, BR-39**	**BR-29**	**PC-01, PC-21**	**PC-06, PC-11 PC-22**	**PBBS**	**PM-04, PM-06 PM-12, PM-35 PM-37, JM-01**	**PM-26, PM-28**	**SH-17, SH-23 SH-29, SH-37 SH-43, SH-44**	**SH-06, SH-07 SH-13, SH-14**	**SG-13/14, SG-16 SG-43**	**SG-24, SG-44 SG-53, SG-55 SG-56, SG-58 SG-67, SG-98**	**SG-41, SG-47 SG-48, SG-49/50 SG-51, SG-71 SG-78, SG-82 SG-94, SG-95 SG-96, SG-99**	**SG-01, SG-31 SG-33, SG-35 SG-86, SG-89**	**SWG-01**		**TOTAL**
Improve/Construct Access Roads	$ 27,000	$ 151,200	$ 29,700	$ -	$ 81,000	$ -	$ 67,500	$ 75,600	$ 151,200	$ 89,100	$ 86,400	$ 291,600	$ 64,800	$ 75,600	$ 24,300		$ 1,215,000
Re-Grade Waste Piles, Prep for Lime Treatment	$ 2,250	$ 22,577	$ 1,260	$ -	$ 9,900	$ -	$ 14,868	$ 12,852	$ 52,290	$ 67,365	$ 29,979	$ 203,090	$ 33,656	$ 12,825	$ 1,098		$ 464,009
Load, Haul, Incorporate Lime	$ 1,225	$ 12,291	$ 686	$ -	$ 5,390	$ -	$ 8,094	$ 6,997	$ 28,468	$ 36,675	$ 16,321	$ 110,566	$ 18,323	$ 6,982	$ 598		$ 252,616
Seed, Fertilize, Mulch	$ 558	$ 5,597	$ 312	$ -	$ 2,455	$ -	$ 3,686	$ 3,186	$ 12,964	$ 16,702	$ 7,433	$ 50,353	$ 8,344	$ 3,180	$ 272		$ 115,043
Subtotal	$ 31,033	$ 191,665	$ 31,958	$ -	$ 98,744	$ -	$ 94,149	$ 98,635	$ 244,922	$ 209,842	$ 140,133	$ 655,609	$ 125,123	$ 98,587	$ 26,268		$ 2,046,668
Mob/Demob (10%)	$ 3,103	$ 19,167	$ 3,196	$ -	$ 9,874	$ -	$ 9,415	$ 9,864	$ 24,492	$ 20,984	$ 14,013	$ 65,561	$ 12,512	$ 9,859	$ 2,627		$ 204,667
Subtotal	$ 34,136	$ 210,832	$ 35,154	$ -	$ 108,619	$ -	$ 103,564	$ 108,499	$ 269,414	$ 230,826	$ 154,146	$ 721,169	$ 137,635	$ 108,446	$ 28,895		$ 2,251,335
Contingencies (15%)	$ 5,120	$ 31,625	$ 5,273	$ -	$ 16,293	$ -	$ 15,535	$ 16,275	$ 40,412	$ 34,624	$ 23,122	$ 108,175	$ 20,645	$ 16,267	$ 4,334		$ 337,700
Subtotal	$ 39,256	$ 242,456	$ 40,427	$ -	$ 124,912	$ -	$ 119,098	$ 124,774	$ 309,827	$ 265,450	$ 177,268	$ 829,345	$ 158,280	$ 124,713	$ 33,229		$ 2,589,035
Project Management (5%)	$ 1,963	$ 12,123	$ 2,021	$ -	$ 6,246	$ -	$ 5,955	$ 6,239	$ 15,491	$ 13,273	$ 8,863	$ 41,467	$ 7,914	$ 6,236	$ 1,661		$ 129,452
Engineering (6%)	$ 2,355	$ 14,547	$ 2,426	$ -	$ 7,495	$ -	$ 7,146	$ 7,486	$ 18,590	$ 15,927	$ 10,636	$ 49,761	$ 9,497	$ 7,483	$ 1,994		$ 155,342
Construction Administration (8%)	$ 3,141	$ 19,397	$ 3,234	$ -	$ 9,993	$ -	$ 9,528	$ 9,982	$ 24,786	$ 21,236	$ 14,181	$ 66,348	$ 12,662	$ 9,977	$ 2,658		$ 207,123
Total, Capital Cost	$ 46,715	$ 288,523	$ 48,109	$ -	$ 148,645	$ -	$ 141,727	$ 148,481	$ 368,694	$ 315,886	$ 210,949	$ 986,920	$ 188,353	$ 148,408	$ 39,543		$ 3,080,952
Operations and Maintenance (O & M)																	
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	$ 250	$ 750	$ 250	$ -	$ 500	$ -	$ 750	$ 250	$ 750	$ 500	$ 500	$ 1,000	$ 1,250	$ 500	$ 250		$ 7,500
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	$ 357	$ 3,578	$ 200	$ -	$ 1,569	$ -	$ 2,356	$ 2,037	$ 8,286	$ 10,675	$ 4,751	$ 32,184	$ 5,333	$ 2,032	$ 174		$ 73,532
Total, 30-yr Present Worth, O&M (3%)	$ 5,276	$ 18,469	$ 5,110	$ -	$ 11,453	$ -	$ 17,183	$ 7,046	$ 23,430	$ 21,047	$ 14,805	$ 53,506	$ 30,119	$ 11,941	$ 5,083		$ 224,470
TOTAL CAPITAL COST + O&M	$ 51,991	$ 306,993	$ 53,219	$ -	$ 160,098	$ -	$ 158,909	$ 155,526	$ 392,124	$ 336,933	$ 225,754	$ 1,040,427	$ 218,473	$ 160,349	$ 44,626		$ 3,305,422
TOTAL EA5 IN-SITU NEUTRALIZATION COSTS WITH 30-YR PRESENT WORTH O&M																	**$ 3,305,422**

EA5 COST ESTIMATE DETAIL
IN-SITU TREATMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Mobilization, Bonding, Insurance	LS	$ 204,666.81	1	$ 204,667	10% of construction cost
Improve/Construct Access Roads - Total	LF	$ 18.00	42,150	$ 1,215,000	Includes Clear/Grub/Log, Reclamation
AC-01	LF	$ 18.00	1,500	$ 27,000	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	LF	$ 18.00	8,400	$ 151,200	
BR-29	LF	$ 18.00	1,650	$ 29,700	
PC-01, PC-21	LF	$ 18.00	0	$ -	
PC-06, PC-11, PC-22	LF	$ 18.00	4,500	$ 81,000	
PBBS	LF	$ 18.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	LF	$ 18.00	3,750	$ 67,500	
PM-26, PM-28	LF	$ 18.00	4,200	$ 75,600	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	LF	$ 18.00	8,400	$ 151,200	
SH-06, SH-07, SH-13, SH-14	LF	$ 18.00	4,950	$ 89,100	
SG-13/14, SG-16, SG-43	LF	$ 18.00	4,800	$ 86,400	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	LF	$ 18.00	16,200	$ 291,600	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	LF	$ 18.00	3,600	$ 64,800	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	LF	$ 18.00	4,200	$ 75,600	
SWG-02	LF	$ 18.00	1,350	$ 24,300	
Re-Grade Waste Piles, Prep for Lime Treatment - Total	SY	$ 3.00	71,114	$ 464,009	Engineer Estimate
AC-01	SY	$ 3.00	750	$ 2,250	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	SY	$ 3.00	7,526	$ 22,577	
BR-29	SY	$ 3.00	420	$ 1,260	
PC-01, PC-21	SY	$ 3.00	0	$ -	
PC-06, PC-11, PC-22	SY	$ 3.00	3,300	$ 9,900	
PBBS	SY	$ 3.00	0	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	SY	$ 3.00	4,956	$ 14,868	
PM-26, PM-28	SY	$ 3.00	4,284	$ 12,852	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	SY	$ 3.00	17,430	$ 52,290	
SH-06, SH-07, SH-13, SH-14	SY	$ 3.00	22,455	$ 67,365	
SG-13/14, SG-16, SG-43	SY	$ 3.00	9,993	$ 29,979	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	SY	$ 3.00	67,697	$ 203,090	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	SY	$ 3.00	11,219	$ 33,656	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	SY	$ 3.00	4,275	$ 12,825	
SWG-02	SY	$ 3.00	366	$ 1,098	
Load, Haul, Incorporate Lime - Total	AC	$ 7,905.00	15	$ 252,616	Based on Stucky Ridge - Costs Increased
AC-01	AC	$ 7,905.00	0.15	$ 1,225	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 7,905.00	1.55	$ 12,291	
BR-29	AC	$ 7,905.00	0.09	$ 686	
PC-01, PC-21	AC	$ 7,905.00	0.00	$ -	
PC-06, PC-11, PC-22	AC	$ 7,905.00	0.68	$ 5,390	
PBBS	AC	$ 7,905.00	0.00	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 7,905.00	1.02	$ 8,094	
PM-26, PM-28	AC	$ 7,905.00	0.89	$ 6,997	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 7,905.00	3.60	$ 28,468	
SH-06, SH-07, SH-13, SH-14	AC	$ 7,905.00	4.64	$ 36,675	
SG-13/14, SG-16, SG-43	AC	$ 7,905.00	2.06	$ 16,321	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 7,905.00	13.99	$ 110,566	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 7,905.00	2.32	$ 18,323	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 7,905.00	0.88	$ 6,982	
SWG-02	AC	$ 7,905.00	0.08	$ 598	

EA5 COST ESTIMATE DETAIL
IN-SITU TREATMENT

CAPITAL COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Seed, Fertilize, Mulch - Total	AC	$ 3,000.00	17.6	$ 115,043	Based on Bald Butte
AC-01	AC	$ 3,000.00	0.19	$ 558	
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	AC	$ 3,000.00	1.87	$ 5,597	
BR-29	AC	$ 3,000.00	0.10	$ 312	
PC-01, PC-21	AC	$ 3,000.00	0.00	$ -	
PC-06, PC-11, PC-22	AC	$ 3,000.00	0.82	$ 2,455	
PBBS	AC	$ 3,000.00	0.00	$ -	
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	AC	$ 3,000.00	1.23	$ 3,686	
PM-26, PM-28	AC	$ 3,000.00	1.06	$ 3,186	
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	AC	$ 3,000.00	4.32	$ 12,964	
SH-06, SH-07, SH-13, SH-14	AC	$ 3,000.00	5.57	$ 16,702	
SG-13/14, SG-16, SG-43	AC	$ 3,000.00	2.48	$ 7,433	
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	AC	$ 3,000.00	16.78	$ 50,353	
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78 SG-82 SG-94, SG-95, SG-96, SG-99	AC	$ 3,000.00	2.78	$ 8,344	
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	AC	$ 3,000.00	1.06	$ 3,180	
SWG-02	AC	$ 3,000.00	0.09	$ 272	
			Subtotal	$ 2,251,335	
Contingencies		15%		$ 337,700	
			Subtotal	$ 2,589,035	
Project Management		5%		$ 129,452	
Engineering		6%		$ 155,342	
Construction Management		8%		$ 207,123	
TOTAL				$ 3,080,952	
			TOTAL CAPITAL COSTS	**$ 3,080,952**	

OPERATIONS AND MAINTENANCE (O & M) COSTS

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Site Inspections, Vegetation Maintenance and Repairs, Years 1-30	LS	$ 7,500.00	1	$ 7,500	Engineers Estimate
Periodic Repairs - Years 15 and 30 (1/5th remedial cost)	LS	$ 73,531.93	1	$ 73,532	Engineers Estimate
			Subtotal	$ 81,032	
			30-YEAR NET PRESENT VALUE ANNUAL O&M COSTS	**$ 224,495**	**Discounted using the rate below**

3% Assumed Discount Rate

30-YEAR PRESENT VALUE (CAPITAL + O&M COST) **$3,305,447** Value for the EA as a whole is slightly different than value calculated by summing individual sites within the EA due to compounding rounding error.

EA 5 QUANTITY ESTIMATES					
SITE	**WASTE**		**ACCESS - DIST. TO ROADS**		
	AREA	**VOLUME**	**LENGTH**	**IMPROVE?**	**FENCING**
	(sf)	**(cy)**	**(ft)**		**(ft)**
AC-01	6,750	500	1,500	YES	370
BR-01, BR-14, BR-16, BR-20, BR-32, BR-39	67,730	5,017	8,400	YES	1,190
BR-29	3,780	280	1,650	YES	280
PC-01, PC-21	0	0	1,200	YES	0
PC-06, PC-11, PC-22	29,700	2,200	4,500	YES	790
PBBS	0	0	2,100	YES	0
PM-04, PM-06, PM-12, PM-35 PM-37, JM-01	44,604	3,304	3,750	YES	960
PM-26, PM-28	38,556	2,856	4,200	YES	900
SH-17, SH-23, SH-29, SH-37, SH-43, SH-44	156,870	11,620	8,400	YES	1,810
SH-06, SH-07, SH-13, SH-14	202,095	14,970	4,950	YES	2,050
SG-13/14, SG-16, SG-43	89,937	6,662	4,800	YES	1,370
SG-24, SG-44, SG-53, SG-55, SG-56, SG-58, SG-67, SG-98	609,269	45,131	16200	YES	3,560
SG-41, SG-47, SG-48, SG-49/50 SG-51, SG-71, SG-78, SG-82 SG-94, SG-95, SG-96, SG-99	100,967	7,479	3,600	YES	1,450
SG-01, SG-31, SG-33, SG-35, SG-86, SG-89	38,475	2,850	4200	YES	890
SWG-02	3294	244	1350	YES	260
TOTALS	1,392,026	103,113	70,800		15,880

Improve/Reconstruct Access Roads

	ft	$/acre	$/sf	$/lf	
width	14				
Clear & Grub		5175	0.1188017	2.00	
Grading/Earthwork				11	Bald Butte
Reclaim				5	
				18.00	

Retention pond

FLOW	0.1	GPM	
VOLUME	52560	CF/YEAR	
AREA	17520	SF	ASSUMING 3' DEPTH
DIMENSIONS			
LENGTH	199		
WIDTH	88		
EXCAVATION VOL	1,298	CY	CUT/FILL BALANCE
ROCK	10	CY	EMERGENCY OVERFLOW

COST		
EXCAV	$12	PER CY
ROCK	$35	PER CY
REVEG	$2,500	PER AC

PER POND $17,130.00

TABLE C.4 - CONCEPTUAL COST ESTIMATE STATE SECTION 18 SITE

DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL PRICE	NOTES
Prepare Repository					
Strip and Stockpile Cover Soil and Subsoil	CY	$2.25	65,000	$ 146,250.00	Estimated 2-foot average is available at this site
Prepare Subgrade	SY	$1.00	96,800	$ 96,800.00	Estimated 20 acres
Special Excavation	CY	$9.00	0	$ -	Not required at this site
Load, Haul, Place, and Grade Structural Berm	CY	$25.00	0	$ -	Not required at this site
Install Geocushion	SY	$3.00	0	$ -	Not required at this site
Install Geomembrane	SY	$6.00	0	$ -	Not required at this site
Install Geocomposite Drainage Layer	SY	$4.00	0	$ -	Not required at this site
Install Leachate Collection System	LS	$37,000.00	0	$ -	Not required at this site
Place Tailings and Waste Rock					
Place and Compact Tailings In Repository	CY	$2.25	1,000,000	$ 2,250,000.00	Based on Bald Butte Bid Tabs
Close Repository					
Install Geomembrane Liner	SY	$6.00	96,800	$ 580,800.00	Based on Bald Butte Bid Tabs
Install Geocomposite Cap Drainage Layer	SY	$4.00	96,800	$ 387,200.00	Based on Bald Butte Bid Tabs
Replace Stockpiled Cover Soil	CY	$1.75	65,000	$ 113,750.00	Stockpiled Portion
Place Imported Cover Soil	CY	$1.20	0	$ -	Import From Nora Creek Site
Amend Cover Soil	TON	$350.00	487.5	$ 170,625	Amendment at 3% of top 6 inches of cover soil
Fertilize and Seed	AC	$800.00	20	$ 16,000	Based on Bald Butte Bid Tabs
Haul Roads					
Road Improvement	LF	$6.00	12,000	$ 72,000	Existing road surface upgrade and maintenance
New Road Construction	LF	$10.00	0	$ -	
Misc. Road Improvement	LS	$20,000.00	1	$ 20,000	Miscellaneous small culverts and highway access
Tailings and Borrow Material Haul					
Haul with Back Haul	CY	$ 6.57	400,000	$ 2,627,358	Assuming 400,000 cy of veg borrow required for reclamation
Haul without Back Haul	CY	$ 10.18	600,000	$ 6,108,607	
Back Haul Veg Borrow	CY	$ 3.61	400,000	$ 1,445,047	Assuming 400,000 cy of veg borrow required for reclamation
Excavate Borrow Materials	CY	$ 2.50	400,000	$ 1,000,000	Assuming 400,000 cy of veg borrow required for reclamation
Off-Site Borrow Area Development					
New Road Construction	LF	$10.00	0	$ -	Access to Nora Creek Site
Strip and Stockpile Cover Soil	CY	$2.25	0	$ -	Strip 2 feet from borrow area
Excavate Borrow Materials	CY	$2.50	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Haul Borrow Material	CY	$3.46	0	$ -	Assuming 400,000 cy of veg borrow required for reclamation
Replace Stockpiled Cover Soil	CY	$1.25	0	$ -	Replace 2 inches of native cover
Fertilize and Seed	Ac	$800.00	0	$ -	Native seed and fertilizer
Other Costs					
Land Acquisition	AC	$1,200.00	0	$ -	Not required at this site
TOTAL				**$ 15,034,436**	

* Cost Estimate taken from UBMC Repository Siting Study (Pioneer, 2011)

$	4,048,472	TOTAL REPOSITORY COST, LESS COST TO HAUL AND PLACE WASTE
$	4.05	PER CUBIC YARD (For 1,000,000 cy repository), LESS COST TO HAUL/PLACE WASTE
	2.50	SCALE FACTOR FOR SMALLER REPOSITORY (1,000,000 cy vs. 400,000 cy)
		ASSUMING ALL WASTE FROM EA1, EA3, AND EA4.
$	**10.12**	**PER CUBIC YARD (For 3400,000 cy repository), LESS COST TO HAUL/PLACE WASTE**

APPENDIX B. MINING-RELATED FEATURES

AC = Anaconda Creek BR = Blackfoot River PC = Pass Creek PM = Paymaster Gulch JM = Jumbo Mine/Paymaster
PBBS = Porcupine Gulch SH = Shave Gulch SG = Stevens Gulch SWG = Swamp Gulch

SITE ID	SITE TYPE	ESTIMATED VOLUME OF WASTE MATERIAL (cy)	WATER OBSERVED	DISTANCE TO NEAREST OBSERVED SURFACE WATER (ft)	PROXIMITY TO EXISTING ACCESS[1]	SAMPLE COLLECTED[2] OBSERVED WATER	SAMPLE COLLECTED[2] SEDIMENT	SAMPLE COLLECTED[2] WASTE AREA	RI COMMENTS/NOTES/HAZARDS	FS EVALUATION NOTES
BR-14	Collapsed adit with waste rock, and discharge, seep, or spring	2,000	X (discharge or seep)	--	Moderate	--	--	--	Collapsed adit with leaking water that is pooled near entrance supporting vegetation. Collapsed tipple and woody debris is present. Mined rock difficult to distinguish from road fill slope and has been graded for structure footings. Adit seepage may be of poor quality for wildlife use.	Located along a reclaimed old road grade approximately 900 ft upgradient from floodplain. Very steep slopes and may require reopening the road and removing some vegetation. Located in a highly mineralized geology zone. A surface water feature was not observed at the time of the inventory. Interaction of the adit seep with surface water was not observed.
BR-29	Collapsed adit with waste rock	280	--	--	Difficult	--	--	--	Collapsed adit and rock pile located in center of gully that may be a seasonal drainage (dry at time of visit). Some potential for impact to surface water during flooding or high run-off events.	Located approximately 350 ft uphill from Mary P Mine in heavy timber on steep slopes, in highly mineralized area. No photos. Unable to verify water; seasonal runoff channel. No proximity to existing roads making access difficult.
BR-39	Collapsed adit with waste rock	32	X (Unnamed tributary to Blackfoot River)	5	Moderate	**BTSW-101 (SW) Chronic: Cd, Zn Acute: Zn**	--	**BTWA-101 (0-6) (As, Pb, Mn, Zn)**	Caved adit and waste pile along edge of unnamed creek. No impacts to vegetation were observed and bushes grew from rock pile.	Located approximately 700 ft uphill from WTP, may be accessible by old road grade. Very steep slopes and may require reopening the road and removing some vegetation. Located in a highly mineralized geology zone. Surface water sample collected from unnamed tributary to Blackfoot River.
PC-01	Physical hazard - open adit (well)	--	X (well)	--	Difficult	PCSW-102 (GW) PCSW-103 (SW) PCSW-104 (SW)	PCSE-103 (0-2) PCSE-104 (0-2)	PCWA-102 (0-6)	Collapsed adit with timber and associated rock pile. A shallow, square, timber-framed "shaft" is nearby with dimensions 5x5x2 ft (possible drinking water well), filled with water.	Located approximately 500 ft east of highway on a steep forested slope. Sediment and surface water samples PCSW-103/104 are located upstream and downstream of the site. Water sample PCSW-102 was collected from an adit seep.
PC-06	Collapsed adit with waste rock	1,700	--	--	Difficult	--	--	--	Collapsed adit portal with large non-vegetated mined rock dump and scattered timbers and metal debris. Mined rock appears phytotoxic and may present metal mobility hazard.	Located approximately 1 mile up Pass Creek Road on a steep heavily timbered slope. May be accessible through old road grades but is in a remote location.
PM-04	Disturbed area	106	--	--	Moderate	--	--	--	Exploratory pit. Possible tailings and metal mobility or phytotoxicity from rock pile.	Located 200 ft south of upper edge of Paymaster Repository road and 450 ft upgradient from Paymaster Creek. Disturbed area with no other signs of mining activities and no roads to the site. Moderate slope above the repository would make access possible, but would need to construct an access road.
PM-06	Disturbed area	423	--	--	Difficult	--	--	--	Two trenches located near digout. Possible tailings. Possible metal mobility or phytotoxicity from rock pile.	Located 500 ft south of upper edge of Paymaster Repository road and 400 ft upslope from Paymaster Creek, on a steep slope with heavy timber not close to any existing roads for easy accessibility. A disturbed area with no other signs of mining activities and no roads to the site.

AC = Anaconda Creek BR = Blackfoot River PC = Pass Creek PM = Paymaster Gulch JM = Jumbo Mine/Paymaster
PBBS = Porcupine Gulch SH = Shave Gulch SG = Stevens Gulch SWG = Swamp Gulch

SITE ID	SITE TYPE	ESTIMATED VOLUME OF WASTE MATERIAL (cy)	WATER OBSERVED	DISTANCE TO NEAREST OBSERVED SURFACE WATER (ft)	PROXIMITY TO EXISTING ACCESS[1]	SAMPLE COLLECTED[2] OBSERVED WATER	SAMPLE COLLECTED[2] SEDIMENT	SAMPLE COLLECTED[2] WASTE AREA	RI COMMENTS/NOTES/HAZARDS	FS EVALUATION NOTES
JM-01	Disturbed area	542	--	--	Difficult	--	--	--	Adit trench and waste pile onsite. Possible metal mobility or phytotoxicity from rock pile.	Located 0.2 miles from Paymaster wetland cells on forested slopes, may be accessible by reclaimed old road grade. Would require reopening the road and removing over 40 years of tree and shrub growth.
SH-13	Collapsed adit with waste rock	5,600	--	--	Moderate	--	--	--	Little to no vegetation on mined rock or near toe. Faint sulfur smell was detected. Possible metal mobility and acid generation from mined rock. Rock is impacting vegetation.	Located 0.75 miles up Pass Creek Shave Gulch ridgeline road, 90 ft downslope from old road grade, 0.2 miles upgradient from Shave Creek. Slope is steep, with heavy timber, and no maintained roads. Area surrounding the site is vegetated with trees and shrubs.
SH-14	Collapsed adit with waste rock	8,000	--	--	Difficult	--	--	--	Very large mined rock dump and possibly three collapsed adits. Two collapsed wooden structures. Sulfur smell and impacted vegetation extending 75 ft below rock pile. Erosion channel cut into ground below rock pile but area is far from surface water. Possible metal mobility and acid generation from mined rock. Rock is impacting vegetation.	Located 1 mile from Mike Horse Mine Road along Pass Creek Shave Gulch ridgeline unmaintained road and 0.25 miles from nearest road grade. Site is 0.3 miles upgradient from Shave Creek. Vegetation is observed from site photo, and area surrounding the site is vegetated with trees and shrubs.
SH-29	Collapsed adit with waste rock	125	--	--	Moderate	--	--	--	Collapsed Upper Consolation adit. With up to 7 small prospect pits nearby. Possible metal mobility or phytotoxicity from rock pile	Located 0.5 ft along existing accessible road and additional 0.1 miles upslope without any roads, near Consolation Mine. Vegetation is observed from site photo, and area surrounding the site is vegetated with heavy timber and shrubs.
SH-37	Collapsed adit with waste rock	55	--	--	Difficult	--	--	--	Rock pile located at head of seasonal drainage/run-off channel. Channel was dry at time of visit. Potential for impacts to surface water when seasonal run-off channel is flowing.	Located 0.5 ft along existing accessible road and additional 0.2 miles along unmaintained road grade, near Consolation Mine. Located 900 ft upslope from bottom of Shave Gulch Road and 1000 ft from Shave Creek, on steep timbered slope, near Consolation Mine. Remote location, not in close proximity to any old road grades. Vegetation is observed in site photo. Site is located in seasonal runoff channel but no evidence of runoff during inventory.
SG-13/14	Disturbed area	5,551	--	--	Difficult	--	--	--	Large waste rock pile up to 20 ft deep and trench. Possible metal mobility or phytotoxicity from rock pile.	Located 1.8 miles from Meadow Creek road on unmaintained access roads and 0.25 miles from Stevens Creek, on the ridge top between Stevens Gulch and Mike Horse Mine. Site is located on very steep timbered slopes with no maintained roads. Features SG-13 and SG-14 have the same field GPS location in the RI and were combined as one feature for the FS.
SG-16	Disturbed area	333	--	--	Difficult	--	--	--	Trench above possible adit location with large rock piles associated with both sites. Possible metal mobility or phytotoxicity from rock pile.	Located 1.8 miles from Meadow Creek road on unmaintained access roads and 0.20 miles upslope from Stevens Creek. Located near the ridgetop between Stevens Gulch and Mike Horse Mine on steep timbered slopes.

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SITE ID	SITE TYPE	ESTIMATED VOLUME OF WASTE MATERIAL (cy)	WATER OBSERVED	DISTANCE TO NEAREST OBSERVED SURFACE WATER (ft)	PROXIMITY TO EXISTING ACCESS[1]	SAMPLE COLLECTED[2] OBSERVED WATER	SAMPLE COLLECTED[2] SEDIMENT	SAMPLE COLLECTED[2] WASTE AREA	RI COMMENTS/NOTES/HAZARDS	FS EVALUATION NOTES
SG-41	Disturbed area	2,444	--	--	Difficult	--	--	--	Exploratory trench with possible tailings. Possible metal mobility or phytotoxicity from excavated rock and/or tailings.	Located 1.6 miles from Meadow Creek road on unmaintained access roads and 150 ft from Stevens Creek Steep slopes in heavy timber.
SG-43	Disturbed area	778	--	--	Difficult	--	--	--	Exploratory pit with possible tailings. Photo 78 of ridge to the NE, no mining activity evident. Numerous roadcuts. Possible metal mobility or phytotoxicity from rock pile.	Located 1.8 miles from Meadow Creek road on unmaintained access roads and 600 ft from Stevens Creek, near the ridge top between Stevens Gulch and Mike Horse Mine. Site is located on very steep timbered slopes with no maintained roads.
SG-47	Collapsed adit with waste rock	278	X (Stevens Creek)	0	Difficult	--	--	--	Potential adit location. Tailings material in creek. Open Adit. Potential metal loading to creek.	Located 1.5 miles up Stevens Gulch from Meadow Creek road on unmaintained access road. Slope is very steep with no accessible roads and heavy timber. Waste rock pile in contact with an intermittent portions of Stevens Creek, based on site photos; tailings are not evident in photo. This feature is no longer an open adit and is collapsed.
SG-48	Collapsed adit with waste rock	28	X (Stevens Creek)	0	Difficult	--	--	--	Adit in rock face adjacent to creek. Tailings material in creek. Open Adit. Potential metal loading to creek.	Located 1 mile up Stevens Gulch, 20 ft east of nearest road grade. Slope is very steep with no accessible roads and heavy timber. Area is vegetated with trees, shrubs, and plants. Waste rock pile may be in contact with an intermittent portions of Stevens Creek, based on site photos. Tailings are not evident. This feature is no longer an open adit and is collapsed.
SG-49/50	Collapsed adit with waste rock	999	X (ephemeral creek)	0	Difficult	--	--	--	Mined rock associated with adit SG-51. Located adjacent to ephemeral creek. Possible metal mobility or phytotoxicity from rock pile.	Located 1.4 miles up Stevens Gulch 200 ft from Stevens Creek on unmaintained access road. Slope is steep with unmaintained roads and heavy timber. Waste rock pile may be in contact with an intermittent portions of ephemeral creek, based on site photos. This feature is no longer an open adit and is collapsed. The area surrounding the collapsed opening is covered with moss, plant litter, and shrubs. Adit is associated with SG-50, not SG-51; features SG-49 and SG-50 are related and combined as one feature for FS.
SG-51	Disturbed area	370	X (Stevens Creek)	0	Difficult	--	--	--	Large cutslope with rock pushed into creek. Possible metal mobility or sediment loading from fill material.	Located 1.5 miles up Stevens Gulch from Meadow Creek road on unmaintained roads in close proximity to Stevens Creek. Slope is very steep with no accessible roads and heavy timber. Based on site photos, this looks like a disturbed area and the surroundings areas are vegetated. Photos do not show rock pushed into the creek.
SG-71	Collapsed adit with waste rock, and discharge, seep, or spring	463	X (spring)	70 (from Stevens Creek)	Difficult	--	--	--	Spring at possible adit location 70 ft from creek. Water has pooled and is 6 inches deep. Vegetation is in good condition adjacent to pond.	Located 1.3 miles up Stevens Gulch road along west side of draw from Meadow Creek road, and an additional 200 ft downgradient from road grade, 80 ft upgradient of Stevens Creek. Slope is steep, with heavy timber, and no maintained roads. Trees are growing around the site.

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PBBS = Porcupine Gulch SH = Shave Gulch SG = Stevens Gulch SWG = Swamp Gulch

SITE ID	SITE TYPE	ESTIMATED VOLUME OF WASTE MATERIAL (cy)	WATER OBSERVED	DISTANCE TO NEAREST OBSERVED SURFACE WATER (ft)	PROXIMITY TO EXISTING ACCESS[1]	SAMPLE COLLECTED[2] OBSERVED WATER	SAMPLE COLLECTED[2] SEDIMENT	SAMPLE COLLECTED[2] WASTE AREA	RI COMMENTS/NOTES/HAZARDS	FS EVALUATION NOTES
SG-93	Surface Water/Sediment	--	X (Stevens Creek)	50	Difficult	**SGSW-101 (SW)** **Chronic: Cu, Pb** **Acute: Cu** SGSW-102 (SW)	**SGSE-102 (0-6)** **As, Cd, Cu, Pb, Zn**	SGWA-101	--	Located 1.4 miles up Stevens Gulch from Meadow Creek Road on unmaintained road, waste pile is 200 ft upgradient from Stevens Creek on unmaintained access road. Slope is steep with heavy timber.
SG-94	Disturbed area with discharge, seep, or spring	500 [3]	X (spring)	--	Difficult	**SGSW-103 (SW)** **Chronic: Cd, Cu, Zn** **Acute: Cu, Zn** **SGSW-104 (SW)** **HH: As, Fe** **Chronic: Fe, Zn** **Acute: Zn**	**SGSE-103 (0-2)** **As, Cd, Cu, Pb, Zn** **SGSE-104 (0-2)** **As**	SGWA-102	Iron precipitate cone-forming spring. Actually located about 250 ft downstream of SG-94 location.	Located 1.4 miles up Stevens Gulch from Meadow Creek road on unmaintained roads in close proximity to Stevens Creek. Slope is very steep with no accessible roads and heavy timber. Located 200 ft east of nearest road grade. This feature is a spring in a highly mineralized area, and not in close proximity to any surface water.
SWG-02	Disturbed area	244		--	Difficult	--	--	--	Possible tailings in rock piles. Excavated rock may present metal mobility or other phytotoxicity hazard.	Located 300 ft northeast of the Meadow Creek Road to WTP on steep slopes with heavy timber. This site is not accessible by any road grades. Area has established vegetation including shrubs and trees.

Notes: cy: cubic yard. ft: feet. gmp: gallons per minute

[1]**Access Definitions**

Easy - Located close to existing road.

Moderate - Located close to old road grade on mild slopes with less timber.

Difficult - Remotely located due to inaccessibility (steep timber slopes or unmaintained roads), may be in proximity to other mine features that are difficult to access.

[2] Sample identification listed for areas where sample was collected. **Bold** text indicates that sample exceeded SSCLs.

[3] Volume was not recorded in field notes and is an estimation.

[4] Volume was estimated based on area from Table 12 of Remedial Investigation (RI).

APPENDIX C. PRO-UCL CALCULATIONS

	A	B	C	D	E	F	G	H	I	J	K	L
1				Background Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			Date/Time of Computation	6/10/2015 11:33:34 AM								
4			From File	Polished_data_file.xls								
5			Full Precision	OFF								
6			Confidence Coefficient	95%								
7			Coverage	95%								
8			Different or Future K Observations	1								
9			Number of Bootstrap Operations	2000								
10												
11	Aluminum											
12												
13						General Statistics						
14						Total Number of Observations	15			Number of Missing Observations	0	
15						Number of Distinct Observations	7					
16						Number of Detects	4			Number of Non-Detects	11	
17						Number of Distinct Detects	3			Number of Distinct Non-Detects	4	
18						Minimum Detect	0.051			Minimum Non-Detect	0.05	
19						Maximum Detect	0.27			Maximum Non-Detect	0.2	
20						Variance Detected	0.0149			Percent Non-Detects	73.33%	
21						Mean Detected	0.157			SD Detected	0.122	
22						Mean of Detected Logged Data	-2.158			SD of Detected Logged Data	0.945	
23												
24						Critical Values for Background Threshold Values (BTVs)						
25						Tolerance Factor K (For UTL)	2.566			d2max (for USL)	2.409	
26												
27						Normal GOF Test on Detects Only						
28						Shapiro Wilk Test Statistic	0.763			Shapiro Wilk GOF Test		
29						5% Shapiro Wilk Critical Value	0.748			Detected Data appear Normal at 5% Significance Level		
30						Lilliefors Test Statistic	0.306			Lilliefors GOF Test		
31						5% Lilliefors Critical Value	0.443			Detected Data appear Normal at 5% Significance Level		
32						Detected Data appear Normal at 5% Significance Level						
33												
34						Kaplan Meier (KM) Background Statistics Assuming Normal Distribution						
35						Mean	0.0786			SD	0.072	
36						95% UTL95% Coverage	0.263			95% KM UPL (t)	0.21	
37						90% KM Percentile (z)	0.171			95% KM Percentile (z)	0.197	
38						99% KM Percentile (z)	0.246			95% KM USL	0.252	
39												
40						DL/2 Substitution Background Statistics Assuming Normal Distribution						
41						Mean	0.0957			SD	0.074	
42						95% UTL95% Coverage	0.286			95% UPL (t)	0.23	
43						90% Percentile (z)	0.191			95% Percentile (z)	0.218	
44						99% Percentile (z)	0.268			95% USL	0.274	
45						DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons						
46												
47						Gamma GOF Tests on Detected Observations Only						
48						A-D Test Statistic	0.674			Anderson-Darling GOF Test		
49						5% A-D Critical Value	0.661			Data Not Gamma Distributed at 5% Significance Level		
50						K-S Test Statistic	0.341			Kolmogrov-Smirnoff GOF		

	A	B	C	D	E	F	G	H	I	J	K	L
51					5% K-S Critical Value	0.399	Detected data appear Gamma Distributed at 5% Significance Level					
52	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
53												
54	**Gamma Statistics on Detected Data Only**											
55					k hat (MLE)	1.798				k star (bias corrected MLE)		0.616
56					Theta hat (MLE)	0.0871				Theta star (bias corrected MLE)		0.254
57					nu hat (MLE)	14.38				nu star (bias corrected)		4.929
58					MLE Mean (bias corrected)	0.157						
59					MLE Sd (bias corrected)	0.199				95% Percentile of Chisquare (2k)		4.392
60												
61	**Gamma ROS Statistics using Imputed Non-Detects**											
62	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
63	GROS may not be used when kstar of detected data is small such as < 0.1											
64	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
65	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
66					Minimum	0.01				Mean		0.0552
67					Maximum	0.27				Median		0.01
68					SD	0.0868				CV		1.572
69					k hat (MLE)	0.715				k star (bias corrected MLE)		0.617
70					Theta hat (MLE)	0.0772				Theta star (bias corrected MLE)		0.0895
71					nu hat (MLE)	21.46				nu star (bias corrected)		18.5
72					MLE Mean (bias corrected)	0.0552				MLE Sd (bias corrected)		0.0703
73					95% Percentile of Chisquare (2k)	4.395				90% Percentile		0.143
74					95% Percentile	0.197				99% Percentile		0.327
75	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
76	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
77					WH	HW					WH	HW
78				95% Approx. Gamma UTL with 95% Coverage	0.346	0.372				95% Approx. Gamma UPL	0.204	0.206
79				95% Gamma USL	0.312	0.331						
80												
81	**The following statistics are computed using gamma distribution and KM estimates**											
82	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
83					k hat (KM)	1.192				nu hat (KM)		35.77
84					WH	HW					WH	HW
85				95% Approx. Gamma UTL with 95% Coverage	0.264	0.264				95% Approx. Gamma UPL	0.188	0.185
86				95% Gamma USL	0.246	0.246						
87												
88	**Lognormal GOF Test on Detected Observations Only**											
89					Shapiro Wilk Test Statistic	0.747	**Shapiro Wilk GOF Test**					
90					5% Shapiro Wilk Critical Value	0.748	Data Not Lognormal at 5% Significance Level					
91					Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**					
92					5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level					
93	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
94												
95	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
96					Mean in Original Scale	0.0576				Mean in Log Scale		-3.599
97					SD in Original Scale	0.0851				SD in Log Scale		1.211
98					95% UTL95% Coverage	0.611				95% BCA UTL95% Coverage		0.27
99					95% Bootstrap (%) UTL95% Coverage	0.27				95% UPL (t)		0.247
100					90% Percentile (z)	0.129				95% Percentile (z)		0.2

	A	B	C	D	E	F	G	H	I	J	K	L
101					99% Percentile (z)	0.457					95% USL	0.506
102												
103					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
104					KM Mean of Logged Data	-2.768					95% KM UTL (Lognormal)95% Coverage	0.264
105					KM SD of Logged Data	0.56					95% KM UPL (Lognormal)	0.174
106					95% KM Percentile Lognormal (z)	0.158					95% KM USL (Lognormal)	0.242
107												
108					**Background DL/2 Statistics Assuming Lognormal Distribution**							
109					Mean in Original Scale	0.0957					Mean in Log Scale	-2.598
110					SD in Original Scale	0.074					SD in Log Scale	0.743
111					95% UTL95% Coverage	0.5					95% UPL (t)	0.287
112					90% Percentile (z)	0.193					95% Percentile (z)	0.252
113					99% Percentile (z)	0.419					95% USL	0.445
114					**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**							
115												
116					**Nonparametric Distribution Free Background Statistics**							
117					**Data appear to follow a Discernible Distribution at 5% Significance Level**							
118												
119					**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**							
120					Order of Statistic, r	15					95% UTL with95% Coverage	0.27
121					Approximate f	0.789					Confidence Coefficient (CC) achieved by UTL	0.537
122					95% UPL	0.27					95% USL	0.27
123					95% KM Chebyshev UPL	0.403						
124												
125					Note: The use of USL to estimate a BTV is recommended only when the data set represents a background							
126					data set free of outliers and consists of observations collected from clean unimpacted locations.							
127					The use of USL tends to provide a balance between false positives and false negatives provided the data							
128					represents a background data set and when many onsite observations need to be compared with the BTV.							
129												
130	**Arsenic**											
131												
132					**General Statistics**							
133					Total Number of Observations	13					Number of Missing Observations	2
134					Number of Distinct Observations	4						
135					Number of Detects	0					Number of Non-Detects	13
136					Number of Distinct Detects	0					Number of Distinct Non-Detects	4
137					Minimum Detect	N/A					Minimum Non-Detect	0.002
138					Maximum Detect	N/A					Maximum Non-Detect	0.02
139					Variance Detected	N/A					Percent Non-Detects	100%
140					Mean Detected	N/A					SD Detected	N/A
141					Mean of Detected Logged Data	N/A					SD of Detected Logged Data	N/A
142												
143					**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**							
144					**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**							
145					**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**							
146												
147					**The data set for variable Arsenic was not processed!**							
148												
149												
150	**Barium**											

	A	B	C	D	E	F	G	H	I	J	K	L
151												
152						General Statistics						
153					Total Number of Observations	5				Number of Missing Observations		4
154					Number of Distinct Observations	1						
155					Number of Detects	0				Number of Non-Detects		5
156					Number of Distinct Detects	0				Number of Distinct Non-Detects		1
157					Minimum Detect	N/A				Minimum Non-Detect		0.2
158					Maximum Detect	N/A				Maximum Non-Detect		0.2
159					Variance Detected	N/A				Percent Non-Detects		100%
160					Mean Detected	N/A				SD Detected		N/A
161					Mean of Detected Logged Data	N/A				SD of Detected Logged Data		N/A
162												
163					Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!							
164					Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!							
165					The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).							
166												
167					The data set for variable Barium was not processed!							
168												
169												
170	Cadmium											
171												
172						General Statistics						
173					Total Number of Observations	15				Number of Missing Observations		0
174					Number of Distinct Observations	3						
175					Number of Detects	1				Number of Non-Detects		14
176					Number of Distinct Detects	1				Number of Distinct Non-Detects		3
177					Minimum Detect	0.005				Minimum Non-Detect		0.001
178					Maximum Detect	0.005				Maximum Non-Detect		0.008
179					Variance Detected	N/A				Percent Non-Detects		93.33%
180					Mean Detected	0.005				SD Detected		N/A
181					Mean of Detected Logged Data	-5.298				SD of Detected Logged Data		N/A
182												
183					Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!							
184					It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).							
185												
186					The data set for variable Cadmium was not processed!							
187												
188												
189	Chromium											
190												
191						General Statistics						
192					Total Number of Observations	5				Number of Missing Observations		4
193					Number of Distinct Observations	1						
194					Number of Detects	0				Number of Non-Detects		5
195					Number of Distinct Detects	0				Number of Distinct Non-Detects		1
196					Minimum Detect	N/A				Minimum Non-Detect		0.01
197					Maximum Detect	N/A				Maximum Non-Detect		0.01
198					Variance Detected	N/A				Percent Non-Detects		100%
199					Mean Detected	N/A				SD Detected		N/A
200					Mean of Detected Logged Data	N/A				SD of Detected Logged Data		N/A

	A	B	C	D	E	F	G	H	I	J	K	L
201												
202	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
203	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
204	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
205												
206	The data set for variable Chromium was not processed!											
207												
208												
209	Cobalt											
210												
211	General Statistics											
212				Total Number of Observations		5			Number of Missing Observations		4	
213				Number of Distinct Observations		1						
214				Number of Detects		0			Number of Non-Detects		5	
215				Number of Distinct Detects		0			Number of Distinct Non-Detects		1	
216				Minimum Detect		N/A			Minimum Non-Detect		0.05	
217				Maximum Detect		N/A			Maximum Non-Detect		0.05	
218				Variance Detected		N/A			Percent Non-Detects		100%	
219				Mean Detected		N/A			SD Detected		N/A	
220				Mean of Detected Logged Data		N/A			SD of Detected Logged Data		N/A	
221												
222	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
223	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
224	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
225												
226	The data set for variable Cobalt was not processed!											
227												
228												
229	Lead											
230												
231	General Statistics											
232				Total Number of Observations		15			Number of Missing Observations		0	
233				Number of Distinct Observations		6						
234				Number of Detects		5			Number of Non-Detects		10	
235				Number of Distinct Detects		4			Number of Distinct Non-Detects		4	
236				Minimum Detect		0.003			Minimum Non-Detect		0.002	
237				Maximum Detect		0.028			Maximum Non-Detect		0.01	
238				Variance Detected		1.1570E-4			Percent Non-Detects		66.67%	
239				Mean Detected		0.0152			SD Detected		0.0108	
240				Mean of Detected Logged Data		-4.457			SD of Detected Logged Data		0.9	
241												
242	Critical Values for Background Threshold Values (BTVs)											
243				Tolerance Factor K (For UTL)		2.566			d2max (for USL)		2.409	
244												
245	Normal GOF Test on Detects Only											
246				Shapiro Wilk Test Statistic		0.885			Shapiro Wilk GOF Test			
247				5% Shapiro Wilk Critical Value		0.762			Detected Data appear Normal at 5% Significance Level			
248				Lilliefors Test Statistic		0.286			Lilliefors GOF Test			
249				5% Lilliefors Critical Value		0.396			Detected Data appear Normal at 5% Significance Level			
250	Detected Data appear Normal at 5% Significance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
251												
252	**Kaplan Meier (KM) Background Statistics Assuming Normal Distribution**											
253					Mean	0.00646				SD		0.00831
254					95% UTL95% Coverage	0.0278				95% KM UPL (t)		0.0216
255					90% KM Percentile (z)	0.0171				95% KM Percentile (z)		0.0201
256					99% KM Percentile (z)	0.0258				95% KM USL		0.0265
257												
258	**DL/2 Substitution Background Statistics Assuming Normal Distribution**											
259					Mean	0.0067				SD		0.00855
260					95% UTL95% Coverage	0.0286				95% UPL (t)		0.0223
261					90% Percentile (z)	0.0177				95% Percentile (z)		0.0208
262					99% Percentile (z)	0.0266				95% USL		0.0273
263	**DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons**											
264												
265	**Gamma GOF Tests on Detected Observations Only**											
266					A-D Test Statistic	0.367				**Anderson-Darling GOF Test**		
267					5% A-D Critical Value	0.684				Detected data appear Gamma Distributed at 5% Significance Level		
268					K-S Test Statistic	0.24				**Kolmogrov-Smirnoff GOF**		
269					5% K-S Critical Value	0.36				Detected data appear Gamma Distributed at 5% Significance Level		
270	**Detected data appear Gamma Distributed at 5% Significance Level**											
271												
272	**Gamma Statistics on Detected Data Only**											
273					k hat (MLE)	2				k star (bias corrected MLE)		0.933
274					Theta hat (MLE)	0.0076				Theta star (bias corrected MLE)		0.0163
275					nu hat (MLE)	20				nu star (bias corrected)		9.334
276					MLE Mean (bias corrected)	0.0152						
277					MLE Sd (bias corrected)	0.0157				95% Percentile of Chisquare (2k)		5.731
278												
279	**Gamma ROS Statistics using Imputed Non-Detects**											
280	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
281	GROS may not be used when kstar of detected data is small such as < 0.1											
282	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
283	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
284					Minimum	0.003				Mean		0.0117
285					Maximum	0.028				Median		0.01
286					SD	0.00628				CV		0.536
287					k hat (MLE)	4.69				k star (bias corrected MLE)		3.796
288					Theta hat (MLE)	0.0025				Theta star (bias corrected MLE)		0.00309
289					nu hat (MLE)	140.7				nu star (bias corrected)		113.9
290					MLE Mean (bias corrected)	0.0117				MLE Sd (bias corrected)		0.00602
291					95% Percentile of Chisquare (2k)	14.92				90% Percentile		0.0198
292					95% Percentile	0.0231				99% Percentile		0.03
293	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
294	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
295					WH	HW					WH	HW
296				95% Approx. Gamma UTL with 95% Coverage	0.031	0.0319				95% Approx. Gamma UPL	0.0237	0.024
297				95% Gamma USL	0.0294	0.0301						
298												
299	**The following statistics are computed using gamma distribution and KM estimates**											
300	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											

	A	B	C	D	E	F	G	H	I	J	K	L
301					k hat (KM)	0.603					nu hat (KM)	18.08
302					WH	HW					WH	HW
303	95% Approx. Gamma UTL with 95% Coverage				0.0324	0.0338	95% Approx. Gamma UPL				0.0205	0.0204
304				95% Gamma USL	0.0296	0.0305						
305												
306	**Lognormal GOF Test on Detected Observations Only**											
307				Shapiro Wilk Test Statistic		0.898	**Shapiro Wilk GOF Test**					
308				5% Shapiro Wilk Critical Value		0.762	Detected Data appear Lognormal at 5% Significance Level					
309				Lilliefors Test Statistic		0.235	**Lilliefors GOF Test**					
310				5% Lilliefors Critical Value		0.396	Detected Data appear Lognormal at 5% Significance Level					
311	**Detected Data appear Lognormal at 5% Significance Level**											
312												
313	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
314				Mean in Original Scale		0.00565				Mean in Log Scale		-6.352
315				SD in Original Scale		0.00906				SD in Log Scale		1.602
316				95% UTL95% Coverage		0.106				95% BCA UTL95% Coverage		0.028
317				95% Bootstrap (%) UTL95% Coverage		0.028				95% UPL (t)		0.0321
318				90% Percentile (z)		0.0136				95% Percentile (z)		0.0243
319				99% Percentile (z)		0.0724				95% USL		0.0826
320												
321	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
322				KM Mean of Logged Data		-5.606				95% KM UTL (Lognormal)95% Coverage		0.0411
323				KM SD of Logged Data		0.941				95% KM UPL (Lognormal)		0.0203
324				95% KM Percentile Lognormal (z)		0.0173				95% KM USL (Lognormal)		0.0354
325												
326	**Background DL/2 Statistics Assuming Lognormal Distribution**											
327				Mean in Original Scale		0.0067				Mean in Log Scale		-5.585
328				SD in Original Scale		0.00855				SD in Log Scale		1.048
329				95% UTL95% Coverage		0.0553				95% UPL (t)		0.0253
330				90% Percentile (z)		0.0144				95% Percentile (z)		0.0211
331				99% Percentile (z)		0.043				95% USL		0.0469
332	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
333												
334	**Nonparametric Distribution Free Background Statistics**											
335	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
336												
337	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
338				Order of Statistic, r		15				95% UTL with95% Coverage		0.028
339				Approximate f		0.789				Confidence Coefficient (CC) achieved by UTL		0.537
340				95% UPL		0.028				95% USL		0.028
341				95% KM Chebyshev UPL		0.0439						
342												
343	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
344	data set free of outliers and consists of observations collected from clean unimpacted locations.											
345	The use of USL tends to provide a balance between false positives and false negatives provided the data											
346	represents a background data set and when many onsite observations need to be compared with the BTV.											
347												
348	**Mercury**											
349												
350	**General Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
351					Total Number of Observations	8					Number of Missing Observations	1
352					Number of Distinct Observations	2						
353					Number of Detects	0					Number of Non-Detects	8
354					Number of Distinct Detects	0					Number of Distinct Non-Detects	2
355					Minimum Detect	N/A					Minimum Non-Detect	2.0000E-4
356					Maximum Detect	N/A					Maximum Non-Detect	5.0000E-4
357					Variance Detected	N/A					Percent Non-Detects	100%
358					Mean Detected	N/A					SD Detected	N/A
359					Mean of Detected Logged Data	N/A					SD of Detected Logged Data	N/A
360												
361					**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**							
362					**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**							
363					**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**							
364												
365					**The data set for variable Mercury was not processed!**							
366												
367												
368	**Molybdenum**											
369												
370					**General Statistics**							
371					Total Number of Observations	8					Number of Missing Observations	1
372					Number of Distinct Observations	2						
373					Number of Detects	0					Number of Non-Detects	8
374					Number of Distinct Detects	0					Number of Distinct Non-Detects	2
375					Minimum Detect	N/A					Minimum Non-Detect	0.02
376					Maximum Detect	N/A					Maximum Non-Detect	0.05
377					Variance Detected	N/A					Percent Non-Detects	100%
378					Mean Detected	N/A					SD Detected	N/A
379					Mean of Detected Logged Data	N/A					SD of Detected Logged Data	N/A
380												
381					**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**							
382					**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**							
383					**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**							
384												
385					**The data set for variable Molybdenum was not processed!**							
386												
387												
388	**Nickel**											
389												
390					**General Statistics**							
391					Total Number of Observations	5					Number of Missing Observations	4
392					Number of Distinct Observations	2						
393					Number of Detects	0					Number of Non-Detects	5
394					Number of Distinct Detects	0					Number of Distinct Non-Detects	2
395					Minimum Detect	N/A					Minimum Non-Detect	0.02
396					Maximum Detect	N/A					Maximum Non-Detect	0.04
397					Variance Detected	N/A					Percent Non-Detects	100%
398					Mean Detected	N/A					SD Detected	N/A
399					Mean of Detected Logged Data	N/A					SD of Detected Logged Data	N/A
400												

	A	B	C	D	E	F	G	H	I	J	K	L
401	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
402	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
403	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
404												
405	The data set for variable Nickel was not processed!											
406												
407												
408	Selenium											
409												
410	General Statistics											
411					Total Number of Observations	8			Number of Missing Observations			1
412					Number of Distinct Observations	2						
413					Number of Detects	0			Number of Non-Detects			8
414					Number of Distinct Detects	0			Number of Distinct Non-Detects			2
415					Minimum Detect	N/A			Minimum Non-Detect			0.005
416					Maximum Detect	N/A			Maximum Non-Detect			0.02
417					Variance Detected	N/A			Percent Non-Detects			100%
418					Mean Detected	N/A			SD Detected			N/A
419					Mean of Detected Logged Data	N/A			SD of Detected Logged Data			N/A
420												
421	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
422	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
423	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
424												
425	The data set for variable Selenium was not processed!											
426												
427												
428	Silver											
429												
430	General Statistics											
431					Total Number of Observations	8			Number of Missing Observations			1
432					Number of Distinct Observations	3						
433					Number of Detects	0			Number of Non-Detects			8
434					Number of Distinct Detects	0			Number of Distinct Non-Detects			3
435					Minimum Detect	N/A			Minimum Non-Detect			3.0000E-4
436					Maximum Detect	N/A			Maximum Non-Detect			0.01
437					Variance Detected	N/A			Percent Non-Detects			100%
438					Mean Detected	N/A			SD Detected			N/A
439					Mean of Detected Logged Data	N/A			SD of Detected Logged Data			N/A
440												
441	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
442	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
443	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
444												
445	The data set for variable Silver was not processed!											
446												
447												

	A	B	C	D	E	F	G	H	I	J	K	L
1				Background Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			Date/Time of Computation	6/10/2015 10:48:24 AM								
4			From File	Polished_data_file.xls								
5			Full Precision	OFF								
6			Confidence Coefficient	95%								
7			Coverage	90%								
8			Different or Future K Observations	1								
9			Number of Bootstrap Operations	2000								
10												
11	Copper											
12												
13						General Statistics						
14						Total Number of Observations	15			Number of Missing Observations	0	
15						Number of Distinct Observations	7					
16						Number of Detects	4			Number of Non-Detects	11	
17						Number of Distinct Detects	4			Number of Distinct Non-Detects	4	
18						Minimum Detect	0.005			Minimum Non-Detect	0.005	
19						Maximum Detect	0.15			Maximum Non-Detect	0.022	
20						Variance Detected	0.00493			Percent Non-Detects	73.33%	
21						Mean Detected	0.0448			SD Detected	0.0702	
22						Mean of Detected Logged Data	-4.012			SD of Detected Logged Data	1.47	
23												
24						Critical Values for Background Threshold Values (BTVs)						
25						Tolerance Factor K (For UTL)	2.068			d2max (for USL)	2.409	
26												
27						Normal GOF Test on Detects Only						
28						Shapiro Wilk Test Statistic	0.675			Shapiro Wilk GOF Test		
29						5% Shapiro Wilk Critical Value	0.748			Data Not Normal at 5% Significance Level		
30						Lilliefors Test Statistic	0.424			Lilliefors GOF Test		
31						5% Lilliefors Critical Value	0.443			Detected Data appear Normal at 5% Significance Level		
32						Detected Data appear Approximate Normal at 5% Significance Level						
33												
34						Kaplan Meier (KM) Background Statistics Assuming Normal Distribution						
35						Mean	0.0157			SD	0.036	
36						95% UTL90% Coverage	0.0901			95% KM UPL (t)	0.0811	
37						90% KM Percentile (z)	0.0618			95% KM Percentile (z)	0.0749	
38						99% KM Percentile (z)	0.0994			95% KM USL	0.102	
39												
40						DL/2 Substitution Background Statistics Assuming Normal Distribution						
41						Mean	0.015			SD	0.0375	
42						95% UTL90% Coverage	0.0926			95% UPL (t)	0.0832	
43						90% Percentile (z)	0.0631			95% Percentile (z)	0.0767	
44						99% Percentile (z)	0.102			95% USL	0.105	
45						DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons						
46												
47						Gamma GOF Tests on Detected Observations Only						
48						A-D Test Statistic	0.607			Anderson-Darling GOF Test		
49						5% A-D Critical Value	0.674			Detected data appear Gamma Distributed at 5% Significance Level		
50						K-S Test Statistic	0.408			Kolmogrov-Smirnoff GOF		

	A	B	C	D	E	F	G	H	I	J	K	L
51					5% K-S Critical Value	0.407	Data Not Gamma Distributed at 5% Significance Level					
52	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
53												
54	**Gamma Statistics on Detected Data Only**											
55					k hat (MLE)	0.671				k star (bias corrected MLE)		0.335
56					Theta hat (MLE)	0.0666				Theta star (bias corrected MLE)		0.134
57					nu hat (MLE)	5.372				nu star (bias corrected)		2.676
58					MLE Mean (bias corrected)	0.0448						
59					MLE Sd (bias corrected)	0.0774				95% Percentile of Chisquare (2k)		2.954
60												
61	**Gamma ROS Statistics using Imputed Non-Detects**											
62	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
63	GROS may not be used when kstar of detected data is small such as < 0.1											
64	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
65	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
66					Minimum	0.005				Mean		0.0193
67					Maximum	0.15				Median		0.01
68					SD	0.0362				CV		1.879
69					k hat (MLE)	1.143				k star (bias corrected MLE)		0.959
70					Theta hat (MLE)	0.0169				Theta star (bias corrected MLE)		0.0201
71					nu hat (MLE)	34.28				nu star (bias corrected)		28.76
72					MLE Mean (bias corrected)	0.0193				MLE Sd (bias corrected)		0.0197
73					95% Percentile of Chisquare (2k)	5.83				90% Percentile		0.0448
74					95% Percentile	0.0586				99% Percentile		0.0906
75	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
76	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
77					WH	HW					WH	HW
78				95% Approx. Gamma UTL with 90% Coverage	0.0673	0.0636				95% Approx. Gamma UPL	0.0576	0.054
79				95% Gamma USL	0.0824	0.0788						
80												
81	**The following statistics are computed using gamma distribution and KM estimates**											
82	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
83					k hat (KM)	0.19				nu hat (KM)		5.69
84					WH	HW					WH	HW
85				95% Approx. Gamma UTL with 90% Coverage	0.0704	0.0661				95% Approx. Gamma UPL	0.0494	0.0454
86				95% Gamma USL	0.0741	0.0699						
87												
88	**Lognormal GOF Test on Detected Observations Only**											
89					Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk GOF Test**					
90					5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level					
91					Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**					
92					5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level					
93	**Detected Data appear Lognormal at 5% Significance Level**											
94												
95	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
96					Mean in Original Scale	0.0124				Mean in Log Scale		-6.969
97					SD in Original Scale	0.0383				SD in Log Scale		2.253
98					95% UTL90% Coverage	0.0994				95% BCA UTL90% Coverage		0.15
99					95% Bootstrap (%) UTL90% Coverage	0.15				95% UPL (t)		0.0567
100					90% Percentile (z)	0.0169				95% Percentile (z)		0.0383

	A	B	C	D	E	F	G	H	I	J	K	L
101					99% Percentile (z)	0.178					95% USL	0.214
102												
103					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
104					KM Mean of Logged Data	-4.946					95% KM UTL (Lognormal)90% Coverage	0.043
105					KM SD of Logged Data	0.87					95% KM UPL (Lognormal)	0.0346
106					95% KM Percentile Lognormal (z)	0.0298					95% KM USL (Lognormal)	0.0579
107												
108					**Background DL/2 Statistics Assuming Lognormal Distribution**							
109					Mean in Original Scale	0.015					Mean in Log Scale	-5.162
110					SD in Original Scale	0.0375					SD in Log Scale	1.056
111					95% UTL90% Coverage	0.0509					95% UPL (t)	0.0391
112					90% Percentile (z)	0.0222					95% Percentile (z)	0.0326
113					99% Percentile (z)	0.0669					95% USL	0.073
114					**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**							
115												
116					**Nonparametric Distribution Free Background Statistics**							
117					**Data appear to follow a Discernible Distribution at 5% Significance Level**							
118												
119					**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**							
120					Order of Statistic, r	15					95% UTL with90% Coverage	0.15
121					Approximate f	1.667					Confidence Coefficient (CC) achieved by UTL	0.794
122					95% UPL	0.15					95% USL	0.15
123					95% KM Chebyshev UPL	0.178						
124												
125					Note: The use of USL to estimate a BTV is recommended only when the data set represents a background							
126					data set free of outliers and consists of observations collected from clean unimpacted locations.							
127					The use of USL tends to provide a balance between false positives and false negatives provided the data							
128					represents a background data set and when many onsite observations need to be compared with the BTV.							
129												
130	**Iron**											
131												
132					**General Statistics**							
133					Total Number of Observations	15					Number of Missing Observations	0
134					Number of Distinct Observations	14						
135					Number of Detects	14					Number of Non-Detects	1
136					Number of Distinct Detects	14					Number of Distinct Non-Detects	1
137					Minimum Detect	0.092					Minimum Non-Detect	0.18
138					Maximum Detect	3.155					Maximum Non-Detect	0.18
139					Variance Detected	0.785					Percent Non-Detects	6.667%
140					Mean Detected	0.605					SD Detected	0.886
141					Mean of Detected Logged Data	-1.208					SD of Detected Logged Data	1.125
142												
143					**Critical Values for Background Threshold Values (BTVs)**							
144					Tolerance Factor K (For UTL)	2.068					d2max (for USL)	2.409
145												
146					**Normal GOF Test on Detects Only**							
147					Shapiro Wilk Test Statistic	0.633					**Shapiro Wilk GOF Test**	
148					5% Shapiro Wilk Critical Value	0.874					Data Not Normal at 5% Significance Level	
149					Lilliefors Test Statistic	0.355					**Lilliefors GOF Test**	
150					5% Lilliefors Critical Value	0.237					Data Not Normal at 5% Significance Level	

	A	B	C	D	E	F	G	H	I	J	K	L
151	Data Not Normal at 5% Significance Level											
152												
153	Kaplan Meier (KM) Background Statistics Assuming Normal Distribution											
154					Mean	0.573				SD		0.834
155					95% UTL90% Coverage	2.297				95% KM UPL (t)		2.09
156					90% KM Percentile (z)	1.642				95% KM Percentile (z)		1.944
157					99% KM Percentile (z)	2.513				95% KM USL		2.581
158												
159	DL/2 Substitution Background Statistics Assuming Normal Distribution											
160					Mean	0.571				SD		0.864
161					95% UTL90% Coverage	2.358				95% UPL (t)		2.143
162					90% Percentile (z)	1.678				95% Percentile (z)		1.992
163					99% Percentile (z)	2.581				95% USL		2.653
164	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
165												
166	Gamma GOF Tests on Detected Observations Only											
167					A-D Test Statistic	1.309				Anderson-Darling GOF Test		
168					5% A-D Critical Value	0.767				Data Not Gamma Distributed at 5% Significance Level		
169					K-S Test Statistic	0.245				Kolmogrov-Smirnoff GOF		
170					5% K-S Critical Value	0.237				Data Not Gamma Distributed at 5% Significance Level		
171	Data Not Gamma Distributed at 5% Significance Level											
172												
173	Gamma Statistics on Detected Data Only											
174					k hat (MLE)	0.836				k star (bias corrected MLE)		0.705
175					Theta hat (MLE)	0.724				Theta star (bias corrected MLE)		0.859
176					nu hat (MLE)	23.41				nu star (bias corrected)		19.73
177					MLE Mean (bias corrected)	0.605						
178					MLE Sd (bias corrected)	0.721				95% Percentile of Chisquare (2k)		4.785
179												
180	Gamma ROS Statistics using Imputed Non-Detects											
181	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
182	GROS may not be used when kstar of detected data is small such as < 0.1											
183	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
184	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
185					Minimum	0.01				Mean		0.566
186					Maximum	3.155				Median		0.18
187					SD	0.868				CV		1.534
188					k hat (MLE)	0.699				k star (bias corrected MLE)		0.604
189					Theta hat (MLE)	0.809				Theta star (bias corrected MLE)		0.937
190					nu hat (MLE)	20.98				nu star (bias corrected)		18.11
191					MLE Mean (bias corrected)	0.566				MLE Sd (bias corrected)		0.728
192					95% Percentile of Chisquare (2k)	4.336				90% Percentile		1.469
193					95% Percentile	2.03				99% Percentile		3.388
194	The following statistics are computed using Gamma ROS Statistics on Imputed Data											
195	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
196						WH	HW				WH	HW
197					95% Approx. Gamma UTL with 90% Coverage	2.55	2.7			95% Approx. Gamma UPL	2.118	2.19
198					95% Gamma USL	3.232	3.536					
199												
200	The following statistics are computed using gamma distribution and KM estimates											

	A	B	C	D	E	F	G	H	I	J	K	L
201	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
202					k hat (KM)	0.473					nu hat (KM)	14.19
203					WH	HW					WH	HW
204	95% Approx. Gamma UTL with 90% Coverage				2.727	2.823	95% Approx. Gamma UPL				1.931	1.928
205				95% Gamma USL	2.869	2.988						
206												
207	**Lognormal GOF Test on Detected Observations Only**											
208				Shapiro Wilk Test Statistic		0.865	**Shapiro Wilk GOF Test**					
209				5% Shapiro Wilk Critical Value		0.874	Data Not Lognormal at 5% Significance Level					
210				Lilliefors Test Statistic		0.194	**Lilliefors GOF Test**					
211				5% Lilliefors Critical Value		0.237	Detected Data appear Lognormal at 5% Significance Level					
212	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
213												
214	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
215				Mean in Original Scale		0.573				Mean in Log Scale		-1.269
216				SD in Original Scale		0.863				SD in Log Scale		1.109
217				95% UTL90% Coverage		2.787				95% BCA UTL90% Coverage		3.155
218				95% Bootstrap (%) UTL90% Coverage		3.155				95% UPL (t)		2.115
219				90% Percentile (z)		1.165				95% Percentile (z)		1.743
220				99% Percentile (z)		3.712				95% USL		4.069
221												
222	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
223				KM Mean of Logged Data		-1.267				95% KM UTL (Lognormal)90% Coverage		2.583
224				KM SD of Logged Data		1.072				95% KM UPL (Lognormal)		1.978
225				95% KM Percentile Lognormal (z)		1.642				95% KM USL (Lognormal)		3.723
226												
227	**Background DL/2 Statistics Assuming Lognormal Distribution**											
228				Mean in Original Scale		0.571				Mean in Log Scale		-1.288
229				SD in Original Scale		0.864				SD in Log Scale		1.127
230				95% UTL90% Coverage		2.839				95% UPL (t)		2.144
231				90% Percentile (z)		1.17				95% Percentile (z)		1.762
232				99% Percentile (z)		3.799				95% USL		4.17
233	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
234												
235	**Nonparametric Distribution Free Background Statistics**											
236	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
237												
238	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
239				Order of Statistic, r		15				95% UTL with90% Coverage		3.155
240				Approximate f		1.667				Confidence Coefficient (CC) achieved by UTL		0.794
241				95% UPL		3.155				95% USL		3.155
242				95% KM Chebyshev UPL		4.326						
243												
244	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
245	data set free of outliers and consists of observations collected from clean unimpacted locations.											
246	The use of USL tends to provide a balance between false positives and false negatives provided the data											
247	represents a background data set and when many onsite observations need to be compared with the BTV.											
248												
249	**Zinc**											
250												

	A	B	C	D	E	F	G	H	I	J	K	L
251						General Statistics						
252					Total Number of Observations	15				Number of Missing Observations		0
253					Number of Distinct Observations	11						
254					Number of Detects	7				Number of Non-Detects		8
255					Number of Distinct Detects	6				Number of Distinct Non-Detects		5
256					Minimum Detect	0.0091				Minimum Non-Detect		0.008
257					Maximum Detect	0.584				Maximum Non-Detect		0.02
258					Variance Detected	0.0454				Percent Non-Detects		53.33%
259					Mean Detected	0.102				SD Detected		0.213
260					Mean of Detected Logged Data	-3.542				SD of Detected Logged Data		1.478
261												
262						Critical Values for Background Threshold Values (BTVs)						
263					Tolerance Factor K (For UTL)	2.068				d2max (for USL)		2.409
264												
265						Normal GOF Test on Detects Only						
266					Shapiro Wilk Test Statistic	0.511				Shapiro Wilk GOF Test		
267					5% Shapiro Wilk Critical Value	0.803				Data Not Normal at 5% Significance Level		
268					Lilliefors Test Statistic	0.463				Lilliefors GOF Test		
269					5% Lilliefors Critical Value	0.335				Data Not Normal at 5% Significance Level		
270						Data Not Normal at 5% Significance Level						
271												
272						Kaplan Meier (KM) Background Statistics Assuming Normal Distribution						
273					Mean	0.0523				SD		0.143
274					95% UTL90% Coverage	0.347				95% KM UPL (t)		0.312
275					90% KM Percentile (z)	0.235				95% KM Percentile (z)		0.287
276					99% KM Percentile (z)	0.384				95% KM USL		0.396
277												
278						DL/2 Substitution Background Statistics Assuming Normal Distribution						
279					Mean	0.0509				SD		0.148
280					95% UTL90% Coverage	0.357				95% UPL (t)		0.32
281					90% Percentile (z)	0.241				95% Percentile (z)		0.294
282					99% Percentile (z)	0.395				95% USL		0.408
283						DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons						
284												
285						Gamma GOF Tests on Detected Observations Only						
286					A-D Test Statistic	1.125				Anderson-Darling GOF Test		
287					5% A-D Critical Value	0.751				Data Not Gamma Distributed at 5% Significance Level		
288					K-S Test Statistic	0.365				Kolmogrov-Smirnoff GOF		
289					5% K-S Critical Value	0.327				Data Not Gamma Distributed at 5% Significance Level		
290						Data Not Gamma Distributed at 5% Significance Level						
291												
292						Gamma Statistics on Detected Data Only						
293					k hat (MLE)	0.503				k star (bias corrected MLE)		0.382
294					Theta hat (MLE)	0.204				Theta star (bias corrected MLE)		0.267
295					nu hat (MLE)	7.037				nu star (bias corrected)		5.355
296					MLE Mean (bias corrected)	0.102						
297					MLE Sd (bias corrected)	0.165				95% Percentile of Chisquare (2k)		3.228
298												
299						Gamma ROS Statistics using Imputed Non-Detects						
300						GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs						

	A	B	C	D	E	F	G	H	I	J	K	L
301	GROS may not be used when kstar of detected data is small such as < 0.1											
302	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
303	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
304					Minimum	0.0091					Mean	0.0531
305					Maximum	0.584					Median	0.01
306					SD	0.147					CV	2.776
307					k hat (MLE)	0.536					k star (bias corrected MLE)	0.473
308					Theta hat (MLE)	0.0991					Theta star (bias corrected MLE)	0.112
309					nu hat (MLE)	16.07					nu star (bias corrected)	14.19
310					MLE Mean (bias corrected)	0.0531					MLE Sd (bias corrected)	0.0772
311					95% Percentile of Chisquare (2k)	3.707					90% Percentile	0.145
312					95% Percentile	0.208					99% Percentile	0.363
313	**The following statistics are computed using Gamma ROS Statistics on Imputed Data**											
314	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
315					WH	HW					WH	HW
316				95% Approx. Gamma UTL with 90% Coverage	0.229	0.211				95% Approx. Gamma UPL	0.186	0.169
317				95% Gamma USL	0.296	0.28						
318												
319	**The following statistics are computed using gamma distribution and KM estimates**											
320	**Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods**											
321					k hat (KM)	0.135					nu hat (KM)	4.037
322					WH	HW					WH	HW
323				95% Approx. Gamma UTL with 90% Coverage	0.263	0.247				95% Approx. Gamma UPL	0.176	0.158
324				95% Gamma USL	0.279	0.263						
325												
326	**Lognormal GOF Test on Detected Observations Only**											
327					Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**					
328					5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level					
329					Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**					
330					5% Lilliefors Critical Value	0.335	Detected Data appear Lognormal at 5% Significance Level					
331	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
332												
333	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
334					Mean in Original Scale	0.0488					Mean in Log Scale	-5.116
335					SD in Original Scale	0.149					SD in Log Scale	1.895
336					95% UTL90% Coverage	0.302					95% BCA UTL90% Coverage	0.584
337					95% Bootstrap (%) UTL90% Coverage	0.584					95% UPL (t)	0.188
338					90% Percentile (z)	0.068					95% Percentile (z)	0.135
339					99% Percentile (z)	0.493					95% USL	0.576
340												
341	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
342					KM Mean of Logged Data	-4.197					95% KM UTL (Lognormal)90% Coverage	0.153
343					KM SD of Logged Data	1.121					95% KM UPL (Lognormal)	0.116
344					95% KM Percentile Lognormal (z)	0.0951					95% KM USL (Lognormal)	0.224
345												
346	**Background DL/2 Statistics Assuming Lognormal Distribution**											
347					Mean in Original Scale	0.0509					Mean in Log Scale	-4.426
348					SD in Original Scale	0.148					SD in Log Scale	1.317
349					95% UTL90% Coverage	0.182					95% UPL (t)	0.131
350					90% Percentile (z)	0.0647					95% Percentile (z)	0.104

	A	B	C	D	E	F	G	H	I	J	K	L
351					99% Percentile (z)	0.256					95% USL	0.285
352					DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.							
353												
354					Nonparametric Distribution Free Background Statistics							
355					Data appear to follow a Discernible Distribution at 5% Significance Level							
356												
357					Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)							
358					Order of Statistic, r	15					95% UTL with90% Coverage	0.584
359					Approximate f	1.667					Confidence Coefficient (CC) achieved by UTL	0.794
360					95% UPL	0.584					95% USL	0.584
361					95% KM Chebyshev UPL	0.694						
362												
363					Note: The use of USL to estimate a BTV is recommended only when the data set represents a background							
364					data set free of outliers and consists of observations collected from clean unimpacted locations.							
365					The use of USL tends to provide a balance between false positives and false negatives provided the data							
366					represents a background data set and when many onsite observations need to be compared with the BTV.							
367												
368	Manganese											
369												
370					General Statistics							
371					Total Number of Observations	15					Number of Missing Observations	0
372					Number of Distinct Observations	10						
373					Number of Detects	8					Number of Non-Detects	7
374					Number of Distinct Detects	8					Number of Distinct Non-Detects	3
375					Minimum Detect	0.01					Minimum Non-Detect	0.008
376					Maximum Detect	0.509					Maximum Non-Detect	0.015
377					Variance Detected	0.0295					Percent Non-Detects	46.67%
378					Mean Detected	0.113					SD Detected	0.172
379					Mean of Detected Logged Data	-3.083					SD of Detected Logged Data	1.421
380												
381					Critical Values for Background Threshold Values (BTVs)							
382					Tolerance Factor K (For UTL)	2.068					d2max (for USL)	2.409
383												
384					Normal GOF Test on Detects Only							
385					Shapiro Wilk Test Statistic	0.68					Shapiro Wilk GOF Test	
386					5% Shapiro Wilk Critical Value	0.818					Data Not Normal at 5% Significance Level	
387					Lilliefors Test Statistic	0.284					Lilliefors GOF Test	
388					5% Lilliefors Critical Value	0.313					Detected Data appear Normal at 5% Significance Level	
389					Detected Data appear Approximate Normal at 5% Significance Level							
390												
391					Kaplan Meier (KM) Background Statistics Assuming Normal Distribution							
392					Mean	0.0642					SD	0.129
393					95% UTL90% Coverage	0.33					95% KM UPL (t)	0.298
394					90% KM Percentile (z)	0.229					95% KM Percentile (z)	0.276
395					99% KM Percentile (z)	0.363					95% KM USL	0.374
396												
397					DL/2 Substitution Background Statistics Assuming Normal Distribution							
398					Mean	0.0628					SD	0.134
399					95% UTL90% Coverage	0.339					95% UPL (t)	0.306
400					90% Percentile (z)	0.234					95% Percentile (z)	0.283

	A	B	C	D	E	F	G	H	I	J	K	L
401					99% Percentile (z)	0.374					95% USL	0.385
402	DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons											
403												
404	Gamma GOF Tests on Detected Observations Only											
405					A-D Test Statistic	0.522	Anderson-Darling GOF Test					
406					5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level					
407					K-S Test Statistic	0.24	Kolmogrov-Smirnoff GOF					
408					5% K-S Critical Value	0.306	Detected data appear Gamma Distributed at 5% Significance Level					
409	Detected data appear Gamma Distributed at 5% Significance Level											
410												
411	Gamma Statistics on Detected Data Only											
412					k hat (MLE)	0.671	k star (bias corrected MLE)					0.503
413					Theta hat (MLE)	0.169	Theta star (bias corrected MLE)					0.226
414					nu hat (MLE)	10.74	nu star (bias corrected)					8.043
415					MLE Mean (bias corrected)	0.113						
416					MLE Sd (bias corrected)	0.16	95% Percentile of Chisquare (2k)					3.855
417												
418	Gamma ROS Statistics using Imputed Non-Detects											
419	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
420	GROS may not be used when kstar of detected data is small such as < 0.1											
421	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
422	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
423					Minimum	0.01	Mean					0.0651
424					Maximum	0.509	Median					0.01
425					SD	0.133	CV					2.037
426					k hat (MLE)	0.584	k star (bias corrected MLE)					0.512
427					Theta hat (MLE)	0.112	Theta star (bias corrected MLE)					0.127
428					nu hat (MLE)	17.52	nu star (bias corrected)					15.35
429					MLE Mean (bias corrected)	0.0651	MLE Sd (bias corrected)					0.0911
430					95% Percentile of Chisquare (2k)	3.899	90% Percentile					0.175
431					95% Percentile	0.248	99% Percentile					0.427
432	The following statistics are computed using Gamma ROS Statistics on Imputed Data											
433	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
434					WH	HW					WH	HW
435			95% Approx. Gamma UTL with 90% Coverage		0.3	0.299	95% Approx. Gamma UPL				0.246	0.24
436			95% Gamma USL		0.386	0.398						
437												
438	The following statistics are computed using gamma distribution and KM estimates											
439	Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods											
440					k hat (KM)	0.25	nu hat (KM)					7.489
441					WH	HW					WH	HW
442			95% Approx. Gamma UTL with 90% Coverage		0.348	0.356	95% Approx. Gamma UPL				0.234	0.228
443			95% Gamma USL		0.369	0.38						
444												
445	Lognormal GOF Test on Detected Observations Only											
446					Shapiro Wilk Test Statistic	0.92	Shapiro Wilk GOF Test					
447					5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level					
448					Lilliefors Test Statistic	0.209	Lilliefors GOF Test					
449					5% Lilliefors Critical Value	0.313	Detected Data appear Lognormal at 5% Significance Level					
450	Detected Data appear Lognormal at 5% Significance Level											

	A	B	C	D	E	F	G	H	I	J	K	L
451												
452	**Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects**											
453					Mean in Original Scale	0.0611				Mean in Log Scale		-4.856
454					SD in Original Scale	0.135				SD in Log Scale		2.28
455					95% UTL90% Coverage	0.868				95% BCA UTL90% Coverage		0.509
456					95% Bootstrap (%) UTL90% Coverage	0.509				95% UPL (t)		0.492
457					90% Percentile (z)	0.145				95% Percentile (z)		0.331
458					99% Percentile (z)	1.565				95% USL		1.89
459												
460	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
461					KM Mean of Logged Data	-3.893				95% KM UTL (Lognormal)90% Coverage		0.3
462					KM SD of Logged Data	1.301				95% KM UPL (Lognormal)		0.217
463					95% KM Percentile Lognormal (z)	0.173				95% KM USL (Lognormal)		0.468
464												
465	**Background DL/2 Statistics Assuming Lognormal Distribution**											
466					Mean in Original Scale	0.0628				Mean in Log Scale		-4.134
467					SD in Original Scale	0.134				SD in Log Scale		1.544
468					95% UTL90% Coverage	0.39				95% UPL (t)		0.266
469					90% Percentile (z)	0.116				95% Percentile (z)		0.203
470					99% Percentile (z)	0.581				95% USL		0.661
471	**DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.**											
472												
473	**Nonparametric Distribution Free Background Statistics**											
474	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
475												
476	**Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)**											
477					Order of Statistic, r	15				95% UTL with90% Coverage		0.509
478					Approximate f	1.667				Confidence Coefficient (CC) achieved by UTL		0.794
479					95% UPL	0.509				95% USL		0.509
480					95% KM Chebyshev UPL	0.643						
481												
482	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background											
483	data set free of outliers and consists of observations collected from clean unimpacted locations.											
484	The use of USL tends to provide a balance between false positives and false negatives provided the data											
485	represents a background data set and when many onsite observations need to be compared with the BTV.											
486												

	A	B	C	D	E	F	G	H	I	J	K
1	Site_Code	Sample_Date	pH (LAB)	Aluminum	D_Aluminur	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium
2	BRSW-14	8/12/1991 12:00 AM	7.4	0.2	0	0.02	0			0.008	0
3	BRSW-14	9/12/1991 12:00 AM	7.5	0.27	1	0.02	0			0.008	0
4	BRSW-14	11/12/1991 12:00 AM	7.7	0.2	0	0.02	0			0.008	0
5	BRSW-14	4/15/1992 12:00 AM	7.8	0.2	0	0.008	0	0.2	0	0.005	0
6	BRSW-14	5/4/1992 12:00 AM	7.6	0.2	0	0.008	0	0.2	0	0.005	0
7	BRSW-14	5/18/1992 12:00 AM	7.8	0.2	0	0.008	0	0.2	0	0.005	0
8	BRSW-14	6/2/1992 12:00 AM	7.8	0.2	0	0.008	0	0.2	0	0.005	0
9	BRSW-14	6/2/1993 12:00 AM	6.5	0.254	1					0.005	1
10	BRSW-14	10/27/1993 12:00 AM	7.7	0.1	0	0.003	0	0.2	0	0.001	0
11	BRSW-14	5/17/1994 12:00 AM	7.6	0.17	0					0.001	0
12	BRSW-14	10/25/1994 12:00 AM	7.5	0.051	1	0.002	0			0.001	0
13	BRSW-14	5/2/1995 12:00 AM	7.7	0.051	1	0.002	0			0.001	0
14	BRSW-14	10/23/1995 12:00 AM	7.9	0.05	0	0.002	0			0.001	0
15	BRSW-14	5/20/1996 12:00 AM	7.8	0.05	0	0.002	0			0.001	0
16	BRSW-14	10/22/1996 12:00 AM	7.6	0.05	0	0.002	0			0.001	0

	L	M	N	O	P	Q	R	S	T	U	V	W
1	Chromium	D_Chromiur	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron	Lead	D_Lead	Manganese	D_Mangane
2					0.011	1	0.35	1	0.01	0	0.021	1
3					0.022	0	1.7	1	0.025	1	0.099	1
4					0.008	0	0.21	1	0.01	0	0.01	1
5	0.01	0	0.05	0	0.008	0	0.134	1	0.005	0	0.008	0
6	0.01	0	0.05	0	0.008	0	0.125	1	0.005	0	0.008	0
7	0.01	0	0.05	0	0.008	0	0.451	1	0.01	1	0.043	1
8	0.01	0	0.05	0	0.008	0	0.092	1	0.005	0	0.008	0
9					0.15	1	3.155	1	0.028	1	0.509	1
10	0.01	0	0.05	0	0.01	0	0.159	1	0.003	0	0.015	0
11					0.005	1	0.18	0	0.002	0	0.011	1
12					0.013	1	1.381	1	0.01	1	0.194	1
13					0.005	0	0.29	1	0.003	0	0.01	0
14					0.005	0	0.096	1	0.003	1	0.01	0
15					0.005	0	0.18	1	0.003	0	0.01	0
16					0.005	0	0.15	1	0.003	0	0.02	1

	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1	Mercury	D_Mercury	Molybdenun	D_Molybder	Nickel	D_Nickel	Selenium	D_Selenium	Silver	D_Silver	Zinc	D_Zinc
2	0.0005	0	0.02	0			0.02	0	0.008	0	0.018	0
3	0.0005	0	0.02	0			0.02	0	0.008	0	0.008	0
4	0.0005	0	0.02	0			0.02	0	0.008	0	0.014	1
5	0.0005	0	0.05	0	0.02	0	0.005	0	0.01	0	0.008	0
6	0.0005	0	0.05	0	0.02	0	0.005	0	0.01	0	0.0091	1
7	0.0005	0	0.05	0	0.02	0	0.005	0	0.01	0	0.045	1
8	0.0005	0	0.05	0	0.02	0	0.005	0	0.01	0	0.008	0
9											0.584	1
10	0.0002	0	0.05	0	0.04	0	0.005	0	0.0003	0	0.02	0
11											0.011	1
12											0.042	1
13											0.011	1
14											0.012	0
15											0.01	0
16											0.01	0

CEA1-3-COMP 3 (0-6")	85	
CEA1-3-400 (0-6")	28	
WEA1-400 (0-6")	28	
CEA1-3-00 (0-6")	28	
CEA1-3-350 (0-6")	26	
CEA1-3-COMP 1 (0-6")	25	
CEA1-3-COMP 2 (0-6")	22	
CEA1-3-850 (0-6")	21	
WEA1-350 (0-6")	20	
CEA1-3-250 (0-6")	20	
WEA1-300 (0-6")	20	
WEA1-250 (0-6")	19	
CEA1-3-550 (0-6")	19	
CEA1-3-200 (0-6")	19	
WEA1-00 (0-6")	19	
EEA2-50 (0-6")	18	U
CEA1-3-50 (0-6")	18	
EEA2-300 (0-6")	18	
CEA1-3-750 (0-6")	17	U
CEA1-3-100 (0-6")	17	
WEA1-150 (0-6")	17	
EEA1-400 (0-6")	17	U
EEA1-500 (0-6")	17	U
CEA1-3-650 (0-6")	16	
WEA1-450 (0-6")	16	U
CEA1-3-150 (0-6")	16	U
EEA1-50 (0-6")	15	
EEA1-450 (0-6")	15	U
CEA1-3-800 (0-6")	15	U
WEA1-COMP 1 (0-6")	15	
WEA1-200 (0-6")	15	U
WEA1-COMP 2 (0-6")	14	U
EEA1-350 (0-6")	14	
CEA1-3-700 (0-6")	14	U
WEA1-500 (0-6")	14	U
EEA2-COMP 1 (0-6")	14	
CEA1-3-300 (0-6")	14	
WEA1-550 (0-6")	14	U
EEA2-200 (0-6")	13	JM74
CEA1-3-600 (0-6")	12	
EEA2-100 (0-6")	12	U
EEA1-00 (0-6")	12	
EEA1-300 (0-6")	12	
WEA1-100 (0-6")	12	U
CEA1-3-450 (0-6")	12	U
EEA2-150 (0-6")	11	JM74
EEA1-150 (0-6")	11	

CEA1-3-500 (0-6")	11	
EEA1-250 (0-6")	10	
EEA1-100 (0-6")	9	U
EEA1-COMP 1 (0-6")	9	U
EEA2-250 (0-6")	8	
EEA2-00 (0-6")	7	U
EEA1-200 (0-6")	7	U

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3	User Selected Options											
4	Date/Time of Computation			5/14/2015 12:02:01 PM								
5	From File			UBMC2.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**Arsenic**											
11												
12	**General Statistics**											
13	Total Number of Observations					53	Number of Distinct Observations					19
14							Number of Missing Observations					1
15	Number of Detects					33	Number of Non-Detects					20
16	Number of Distinct Detects					17	Number of Distinct Non-Detects					8
17	Minimum Detect					8	Minimum Non-Detect					7
18	Maximum Detect					28	Maximum Non-Detect					18
19	Variance Detects					29.85	Percent Non-Detects					37.74%
20	Mean Detects					17.33	SD Detects					5.464
21	Median Detects					17	CV Detects					0.315
22	Skewness Detects					0.474	Kurtosis Detects					-0.457
23	Mean of Logged Detects					2.804	SD of Logged Detects					0.321
24												
25	**Normal GOF Test on Detects Only**											
26	Shapiro Wilk Test Statistic					0.944	**Shapiro Wilk GOF Test**					
27	5% Shapiro Wilk Critical Value					0.931	Detected Data appear Normal at 5% Significance Level					
28	Lilliefors Test Statistic					0.101	**Lilliefors GOF Test**					
29	5% Lilliefors Critical Value					0.154	Detected Data appear Normal at 5% Significance Level					
30	**Detected Data appear Normal at 5% Significance Level**											
31												
32	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
33	Mean					14.37	Standard Error of Mean					0.861
34	SD					5.912	95% KM (BCA) UCL					15.8
35	95% KM (t) UCL					15.81	95% KM (Percentile Bootstrap) UCL					15.81
36	95% KM (z) UCL					15.78	95% KM Bootstrap t UCL					15.96
37	90% KM Chebyshev UCL					16.95	95% KM Chebyshev UCL					18.12
38	97.5% KM Chebyshev UCL					19.75	99% KM Chebyshev UCL					22.94
39												
40	**Gamma GOF Tests on Detected Observations Only**											
41	A-D Test Statistic					0.324	**Anderson-Darling GOF Test**					
42	5% A-D Critical Value					0.747	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.0862	**Kolmogrov-Smirnoff GOF**					
44	5% K-S Critical Value					0.153	Detected data appear Gamma Distributed at 5% Significance Level					
45	**Detected data appear Gamma Distributed at 5% Significance Level**											
46												
47	**Gamma Statistics on Detected Data Only**											
48	k hat (MLE)					10.38	k star (bias corrected MLE)					9.461
49	Theta hat (MLE)					1.669	Theta star (bias corrected MLE)					1.832
50	nu hat (MLE)					685.4	nu star (bias corrected)					624.4

	A	B	C	D	E	F	G	H	I	J	K	L
51					MLE Mean (bias corrected)	17.33				MLE Sd (bias corrected)		5.635
52												
53					Gamma Kaplan-Meier (KM) Statistics							
54					k hat (KM)	5.906				nu hat (KM)		626
55					Approximate Chi Square Value (625.99, α)	568.9				Adjusted Chi Square Value (625.99, β)		567.4
56					95% Gamma Approximate KM-UCL (use when n>=50)	15.81				95% Gamma Adjusted KM-UCL (use when n<50)		15.85
57												
58					Gamma ROS Statistics using Imputed Non-Detects							
59					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
60					GROS may not be used when kstar of detected data is small such as < 0.1							
61					For such situations, GROS method tends to yield inflated values of UCLs and BTVs							
62					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
63					Minimum	4.505				Mean		14.19
64					Maximum	28				Median		12.6
65					SD	6.121				CV		0.431
66					k hat (MLE)	5.495				k star (bias corrected MLE)		5.196
67					Theta hat (MLE)	2.582				Theta star (bias corrected MLE)		2.731
68					nu hat (MLE)	582.4				nu star (bias corrected)		550.8
69					MLE Mean (bias corrected)	14.19				MLE Sd (bias corrected)		6.224
70										Adjusted Level of Significance (β)		0.0455
71					Approximate Chi Square Value (550.79, α)	497.4				Adjusted Chi Square Value (550.79, β)		495.9
72					95% Gamma Approximate UCL (use when n>=50)	15.71				95% Gamma Adjusted UCL (use when n<50)		15.76
73												
74					Lognormal GOF Test on Detected Observations Only							
75					Shapiro Wilk Test Statistic	0.967				Shapiro Wilk GOF Test		
76					5% Shapiro Wilk Critical Value	0.931				Detected Data appear Lognormal at 5% Significance Level		
77					Lilliefors Test Statistic	0.0937				Lilliefors GOF Test		
78					5% Lilliefors Critical Value	0.154				Detected Data appear Lognormal at 5% Significance Level		
79					Detected Data appear Lognormal at 5% Significance Level							
80												
81					Lognormal ROS Statistics Using Imputed Non-Detects							
82					Mean in Original Scale	14.46				Mean in Log Scale		2.596
83					SD in Original Scale	5.804				SD in Log Scale		0.389
84					95% t UCL (assumes normality of ROS data)	15.79				95% Percentile Bootstrap UCL		15.83
85					95% BCA Bootstrap UCL	15.89				95% Bootstrap t UCL		15.84
86					95% H-UCL (Log ROS)	15.94						
87												
88					UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed							
89					KM Mean (logged)	2.581				95% H-UCL (KM -Log)		15.96
90					KM SD (logged)	0.411				95% Critical H Value (KM-Log)		1.824
91					KM Standard Error of Mean (logged)	0.063						
92												
93					DL/2 Statistics							
94					DL/2 Normal					DL/2 Log-Transformed		
95					Mean in Original Scale	13.34				Mean in Log Scale		2.453
96					SD in Original Scale	6.797				SD in Log Scale		0.548
97					95% t UCL (Assumes normality)	14.9				95% H-Stat UCL		15.61
98					DL/2 is not a recommended method, provided for comparisons and historical reasons							
99												
100					Nonparametric Distribution Free UCL Statistics							

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Detected Data appear Normal Distributed at 5% Significance Level**											
102												
103	**Suggested UCL to Use**											
104					95% KM (t) UCL	15.81			95% KM (Percentile Bootstrap) UCL			15.81
105												
106	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
107	Recommendations are based upon data size, data distribution, and skewness.											
108	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
109	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
110												

	A	B	C
1	Sample_ID	Arsenic	D_Arsenic
2			
3	CEA1-3-400	28	1
4	WEA1-400 (	28	1
5	CEA1-3-00	28	1
6	CEA1-3-350	26	1
7	CEA1-3-CO	25	1
8	CEA1-3-CO	22	1
9	CEA1-3-850	21	1
10	WEA1-350 (	20	1
11	CEA1-3-250	20	1
12	WEA1-300 (	20	1
13	WEA1-250 (	19	1
14	CEA1-3-550	19	1
15	CEA1-3-200	19	1
16	WEA1-00 (0	19	1
17	EEA2-50 (0-	18	0
18	CEA1-3-50	18	1
19	EEA2-300 (	18	1
20	CEA1-3-750	17	0
21	CEA1-3-100	17	1
22	WEA1-150 (	17	1
23	EEA1-400 (	17	0
24	EEA1-500 (	17	0
25	CEA1-3-650	16	1
26	WEA1-450 (	16	0
27	CEA1-3-150	16	0
28	EEA1-50 (0-	15	1
29	EEA1-450 (	15	0
30	CEA1-3-800	15	0
31	WEA1-COM	15	1
32	WEA1-200 (	15	0
33	WEA1-COM	14	0
34	EEA1-350 (	14	1
35	CEA1-3-700	14	0
36	WEA1-500 (	14	0
37	EEA2-COM	14	1
38	CEA1-3-300	14	1
39	WEA1-550 (	14	0
40	EEA2-200 (	13	1
41	CEA1-3-600	12	1
42	EEA2-100 (	12	0
43	EEA1-00 (0-	12	1
44	EEA1-300 (	12	1
45	WEA1-100 (	12	0
46	CEA1-3-450	12	0
47	EEA2-150 (	11	1
48	EEA1-150 (	11	1
49	CEA1-3-500	11	1
50	EEA1-250 (	10	1

	A	B	C
51	EEA1-100 (	9	0
52	EEA1-COM	9	0
53	EEA2-250 (	8	1
54	EEA2-00 (0-	7	0
55	EEA1-200 (	7	0

A1-3-COMP 3 (0	1380	
CEA1-3-400 (0-6'	324	
A1-3-COMP 1 (0	284	
WEA1-00 (0-6")	246	
WEA1-400 (0-6"	242	
CEA1-3-850 (0-6'	224	
EEA2-50 (0-6")	213	
CEA1-3-750 (0-6'	202	
A1-3-COMP 2 (0	198	
EEA1-400 (0-6")	164	
WEA1-450 (0-6"	158	
CEA1-3-150 (0-6'	153	
EEA1-500 (0-6")	150	
WEA1-350 (0-6"	143	
CEA1-3-800 (0-6'	136	
CEA1-3-250 (0-6'	135	
EEA1-450 (0-6")	132	
WEA1-500 (0-6"	123	
CEA1-3-700 (0-6'	122	
CEA1-3-00 (0-6"	121	
WEA1-550 (0-6"	121	
EEA2-200 (0-6")	120	JM10
EA1-COMP 2 (0-	117	
EEA2-300 (0-6")	116	
WEA1-200 (0-6"	114	
CEA1-3-100 (0-6'	110	
WEA1-150 (0-6"	102	
CEA1-3-200 (0-6'	101	
WEA1-250 (0-6"	99	
EA1-COMP 1 (0-	98	
WEA1-300 (0-6"	97	
CEA1-3-550 (0-6'	96	
EA2-COMP 1 (0-	95	
CEA1-3-50 (0-6"	94	
EEA2-100 (0-6")	91	
WEA1-100 (0-6"	90	
CEA1-3-450 (0-6'	87	
EEA1-350 (0-6")	86	
CEA1-3-350 (0-6'	83	
CEA1-3-300 (0-6'	82	
EEA1-50 (0-6")	78	
CEA1-3-600 (0-6'	77	
EEA1-00 (0-6")	77	
EEA2-150 (0-6")	76	JM10
CEA1-3-650 (0-6'	75	
CEA1-3-500 (0-6'	64	
EEA1-300 (0-6")	54	

EA1-COMP 1 (0-	36	
EEA1-100 (0-6")	35	
EEA1-250 (0-6")	31	
EEA2-250 (0-6")	29	
EEA1-200 (0-6")	27	
EEA2-00 (0-6")	26	
EEA1-150 (0-6")	21	

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation			5/14/2015 12:10:29 PM								
5	From File			WorkSheet.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Lead											
12												
13	General Statistics											
14	Total Number of Observations					54	Number of Distinct Observations					52
15							Number of Missing Observations					0
16	Minimum					21	Mean					139.9
17	Maximum					1380	Median					101.5
18	SD					183.8	Std. Error of Mean					25.01
19	Coefficient of Variation					1.314	Skewness					6.019
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.427	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk P Value					0	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.281	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.121	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					181.8	95% Adjusted-CLT UCL (Chen-1995)					202.9
31							95% Modified-t UCL (Johnson-1978)					185.2
32												
33	Gamma GOF Test											
34	A-D Test Statistic					2.128	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.765	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.157	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.123	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					1.817	k star (bias corrected MLE)					1.729
42	Theta hat (MLE)					76.99	Theta star (bias corrected MLE)					80.93
43	nu hat (MLE)					196.3	nu star (bias corrected)					186.7
44	MLE Mean (bias corrected)					139.9	MLE Sd (bias corrected)					106.4
45							Approximate Chi Square Value (0.05)					156.1
46	Adjusted Level of Significance					0.0456	Adjusted Chi Square Value					155.3
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					167.3	95% Adjusted Gamma UCL (use when n<50)					168.2
50												

	A	B	C	D	E	F	G	H	I	J	K	L
51	**Lognormal GOF Test**											
52					Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk Lognormal GOF Test**					
53					5% Shapiro Wilk P Value	0.00993	Data Not Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.157	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.121	Data Not Lognormal at 5% Significance Level					
56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	3.045			Mean of logged Data			4.641
60					Maximum of Logged Data	7.23			SD of logged Data			0.709
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	162.5			90% Chebyshev (MVUE) UCL			174.6
64					95% Chebyshev (MVUE) UCL	193.7			97.5% Chebyshev (MVUE) UCL			220.1
65					99% Chebyshev (MVUE) UCL	272.1						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data do not follow a Discernible Distribution (0.05)**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	181			95% Jackknife UCL			181.8
72					95% Standard Bootstrap UCL	180.7			95% Bootstrap-t UCL			248.3
73					95% Hall's Bootstrap UCL	345.4			95% Percentile Bootstrap UCL			183.9
74					95% BCA Bootstrap UCL	222.3						
75					90% Chebyshev(Mean, Sd) UCL	214.9			95% Chebyshev(Mean, Sd) UCL			248.9
76					97.5% Chebyshev(Mean, Sd) UCL	296.1			99% Chebyshev(Mean, Sd) UCL			388.7
77												
78	**Suggested UCL to Use**											
79					95% Chebyshev (Mean, Sd) UCL	248.9						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

	A	B
1	Sample_ID	Lead
2		
3	CEA1-3-400	324
4	CEA1-3-CO	284
5	WEA1-00 (0	246
6	WEA1-400 (	242
7	CEA1-3-850	224
8	EEA2-50 (0-	213
9	CEA1-3-750	202
10	CEA1-3-CO	198
11	EEA1-400 (	164
12	WEA1-450 (	158
13	CEA1-3-150	153
14	EEA1-500 (	150
15	WEA1-350 (	143
16	CEA1-3-800	136
17	CEA1-3-250	135
18	EEA1-450 (	132
19	WEA1-500 (	123
20	CEA1-3-700	122
21	CEA1-3-00	121
22	WEA1-550 (	121
23	EEA2-200 (	120
24	WEA1-COM	117
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